DRAFT ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENT MANAGEMENT PLAN

FOR OBTAINING

Environmental Clearance under EIA Notification – 2006
Schedule Sl. No. 1 (a) (i): Mining Project

"B1" CATEGORY – MINOR MINERAL – CLUSTER – NON-FOREST LAND

CLUSTER EXTENT = 17.64.55 ha (2 Proposed + 2 Existing quarries)

Tvl. THIRUPATHI BLUE METAL & M. SAND

ROUGH STONE AND GRAVEL QUARRY

At

Location: Enthoor Village, Marakkanam Taluk, Viluppuram District

Quarry Code	S.F. Nos	Extent in ha	ToR Letter No.
P1	6//1,7/2,7/3,7/4	2.85.0	Lr.No. SEIAA-TN/F.No.9534/ToR-1347/2022 Dated: 10.02.2023
P2	2/1B,2/2,2/3(P),2/5,3,4/1&4/2	8.00.05	Lr.No. SEIAA-TN/F.No.9668/ToR-1351/2022 Dated: 16.02.2023

Proponent Name & Address

Corporate Office	Branch Office
Tvl. Thirupathi Blue Metal & M. Sand **Managing Partner - Thiru. E. Sekar** 2, Bajanai Kovil Street, Natham Kariyacherry Village, Mullikolathur Post, Thirukazhukundram Taluk, Kancheepuram District.	**Tvl. Thirupathi Blue Metal & M. Sand** **Managing Partner - Thiru. E. Sekar** No.5, M.K. Complex, Narasankuppam Road, Anupuram, Kalpakkam, Chengalpattu District - 603 102.

Environmental Consultant
GEO EXPLORATION AND MINING SOLUTIONS
Old No. 260-B, New No. 17,
Advaitha Ashram Road, Alagapuram,
Salem – 636 004, Tamil Nadu, India
Accredited for sector 1 Cat 'A' ,31 & 38 Cat 'B'
Certificate No : NABET/EIA/2225/RA 0276
Phone: 0427-2431989,
Email: ifthiahmed@gmail.com, geothangam@gmail.com
Web: www.gemssalem.com

Laboratory
EHS 360 LABS PRIVATE LIMITED
(Approved by ISO/IEC 17025:2017)
Certificate number- TC-9583
10/2, Ground Floor, 50th Street,
7th Avenue, Ashok Nagar, Chennai – 600 083,
Tamil Nadu, India.

Baseline Monitoring Period: March 2023 to May 2023

JULY 2023

For easy represantation of Proposed and Existing Quarries in the Cluster are given unique codes and identifies and studied in this EIA/ EMP Report.

CODE	Name of the Owner	S.F. Nos	Extent in Ha	Status
P1	Tvl. Thirupathi Blue Metal & M.Sand,	6/1, 7/2, 7/3 and 7/4	2.85.0	TOR obtained vide Lr.No. SEIAA-TN/F.No.9534/SEAC/ToR-1347/2022 Dated: 10.02.2023
P2	Tvl. Thirupathi Blue Metal & M.Sand,	2/1B, 2/2, 2/3 (P), 2/5, 3, 4/1 & 4/2,	8.00.05	TOR obtained vide Lr.No. SEIAA-TN/F.No.9668 /ToR-1351/2022 Dated: 16.02.2023
TOTAL EXTENT			**10.85.05**	
EXISTING QUARRIES				
CODE	**Name of the Owner**	**S.F. Nos**	**Extent in Ha**	**Status**
E1	R.Vignesh.	5/1,2,3,4,5,6,7	3.94.0	26.12.2019 to 25.12.2024
E2	Tvl. Sri Balaji Blue metals and M.Sand,	163/1, 163/2 (P)	2.79.0	19.09.2019 to 18.09.2024
TOTAL EXTENT			**6.79.50**	
Abandoned QUARRY				
EX-1	Sri Balaji Blue metals,	**6/1,7/2,3,4**	2.85.0	18.04.2013 to 17.04.2018
TOTAL EXTENT			**0.69.0**	
TOTAL CLUSTER EXTENT			**17.64.55**	

Cluster area is calculated as per MoEF & CC Notification – S.O. 2269 (E) Dated: 01.07.2016

As per above notification S.O.2269(E) dated : 01.07.2016 in para (b) in Appendix XI,- (ii) (5): The lease not operative for three years or more and leases which have got environmental clearance as on 15th January, 2016 shall not be counted for calculating the area of cluster, but shall be included in the Environment Management Plan and the Regional Environmental Management Plan"

TERMS OF REFERENCE (ToR) COMPLIANCE

P1 – Tvl. Thirupathi Blue Metal & M.Sand

"ToR issued vide Letter No. SEIAA-TN/F.No.9534 /ToR-1347/2022 Dated:10.02.2023"

SPECIFIC CONDITIONS		
1.	The proponent is requested to carry out a survey and enumerate on the structures located within 50m. 100m, 150m, 200m, 250m, 300m and 500m from the boundary of the mine lease area	No, structures in 50m. 100m, 150m, 200m, 250m, 300m from the boundary of the mine lease area.
2	The proponent shall discuss the funds for mitigation measures to be included in the EMP	Detailed in Chapter No.10
3	The proponent shall adhere to the bench height - 5m as stated in the approved mining plan	Noted & Agreed
4	The proponent shall obtain Anna University Star rating system	Noted & Agreed
5	The PP shall discuss about the existing pit details as a separate topic in chapter 7, if Necessary the PP shall revise mining plan accordingly.	Existing Pit Dimensions: Pit I: 1978 Area in S. qm x 2m (D) Pit II: 558 Area in S. qm x 2m(D) Pit III: 3812 Area in S. qm x 12m(D) Pit IV: 1282 Area in S. qm x 12m(D)
6	The PP shall frame Environmental policy and shall appoint Environmental Manger etc	Discussed about Environmental policy in chapter-10
7	There is a tank of about 260m western side, the PP shall study about effect of mining nearby the tank in the EIA report. The PP shall furnish the mitigation measures for the existing Panchayat Tank located at a distance of 260 m from the lease boundary based on the hydrogeological studies carried out by the accredited consultants.	Detailed in Chapter No.4 in Water environment.
8	The PP shall furnish ownership details of all survey numbers in EIA report.	The land documents of owner are attached in annexure
9	The Project Proponent shall conduct the hydro geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within I km (radius) along with the collected water level data for both monsoon and non-monsoon seasons from the PWD / TWAD so as to assess the impacts on the wells due to mining activity. Necessary data and documentation in this regard may be provided	Details of hydro geological study in Chapter No. 3.
10	The proponent shall submit the details regarding the nature of blasting activity which will be carried out.	The detailed in Chapter No. 2.
11	The PP shall furnish DFO letter stating that the proximity distance of Reserve Forests, Protected Areas, sanctuaries, Tiger reserve etc. up to a radius of25 km from the proposed site.	Noted and agreed
12	The PP shall provide individual notice regarding the public Hearing to the nearby house owners located in the vicinity of the project site.	Noted and agreed
13	In the case of proposed lease in an existing (or old) quarry where the benches are non-existent (or) partially formed critical of the bench geometry approved in the Mining plan, the Project Proponent (PP) shall prepare and submit an 'Action plan, for carrying out the realignment	Noted and agreed

	of the 'high wall benches to ensure slope stability in the proposed quarry lease which shall be vetted by the concerned Asst. Director of Geology and Mining, during the time of appraisal for obtaining the EC	
14	The PP shall furnish the affidavit stating that the blasting operation in the proposed quarry is carried out by the statutory competent person .as per the MMR 196l such as blaster, mining mate, mine foreman, IIII Class mines manager appointed by the proponent.	Noted and agreed
15	Since the quarry lies in a cluster situation, the PP shall furnish a Standard Operating Procedure for carrying out the safe blasting operation while considering the adjacent quarries lies in a radial distance of 500 m from their quarry.	Noted and agreed
16	Details of Green belt & fencing shall be included in the EIA Report.	Detailed of Green belt under Chapter 4.
17	The EIA Coordinators shall obtain and furnish the details of quarry/quarries operated by the proponent in the past, either in the same location or elsewhere in the State with video and photographic evidences.	Noted and agreed
18	If the proponent has already carried out the mining activity in the proposed mining lease area after I 5.0 I .2016, then the proponent shall furnish the following details from AD/DD, mines, • What was the period of the operation and stoppage of the earlier mines with last work • permit issued by the AD/DD mines? • Quantity of minerals mined out. • Highest production achieved in any one year • Detail of approved depth of mining. • Actual depth of the mining achieved earlier. • . Name of the person already mined in that leases area.	The quarry lease was previously granted in avour of Sri Balaji Blue metals for Extent: 2.85.0 ha of patta land. Existing Pit Dimensions: Pit I: 1978 Area in S. qm x 2m (D) Pit II: 558 Area in S. qm x 2m(D) Pit III: 3812 Area in S. qm x 12m(D) Pit IV: 1282 Area in S. qm x 12m(D)
19	lf EC and CTO already obtained, the copy of the same shall be submitted	EC and CTO is attached as Annexure
20	whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches	Noted and agreed
21	All comer coordinates of the mine lease area superimposed on a High Resolution Imagery/Topo sheet, topographic sheet, geomorphology, lithology and geology of the mining lease area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Satellite imagery of the project area along with boundary coordinates is given in the Chapter No 1 Geomorphology of the area is given in Chapter No 2 Land use pattern of the project area is tabulated in the Chapter No.2. Land use pattern of the Study area is tabulated in the Chapter No.3
22	The PP shall carry out Drone video survey covering the cluster, Green belt. fencing etc', The PP shall carry out Drone video survey covering the cluster, Green belt. fencing etc',	Drone video covering the cluster area clearly stating the extent of the operation will be submitted in the final EIA report
23	The proponent shall furnish photographs of adequate fencing, green belt along the periphery including replantation of existing trees & safety distance between the adjacent quarries & water	Noted and agreed

	bodies nearby provided as per the approved mining plan'	
24	The Project Proponent shall provide the details of mineral reserves and mineable reserves, planned production capacity, proposed working methodology with justifications' the anticipated impacts of the mining operations on the surrounding environment and the remedial measures for the same	Total Mineable Reserves, Proposed production and working methodology given in the Chapter No.2
25	The project Proponent shall provide the Organization chart indicating the appointment of various statutory officials and other competent persons to be appointed as per the provisions of Mines Act'1952 and the MMR, 196l for carrying out the quarrying operations scientifically and systematically in order to ensure safety and to protect the environment.	Organization chart indicating Proposal for the appointment of Statutory officials is given in the Chapter No.7
26	The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quality, air quality, soil quality & flora/fauna including traffic/vehicular movement study.	Baseline Data were collected for One Season (Pre-Monsoon) March to May 2023 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3
27	The Proponent shall carry out the cumulative impact study due to mining operations carried out in the quarry specifically with reference to the specific environment in terms of soil health, biodiversity, air pollution, water pollution, climate change and flood control & health impacts. Accordingly, the Environment Management plan should be prepared keeping the concerned quarry and the surrounding habitations in the mind.	The Cumulative impact study due to mining operations is explained in chapter – 7
28	Rain water harvesting management with recharging details along with water balance (both monsoon & non-monsoon) be submitted	Noted and agreed
29	Land use of the study area delineating forest area, agricultural land, grazing rand, wildlife sanctuary, national park, migratory routes off fauna water bodies, human settlements and of her ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	
30	Details of the land for storage of overburden/waste Dumps (or) Rejects outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be provided	Not applicable. No waste is anticipitated in the lease area.
31	Proximity to Areas declared as 'critically polluted' (or) the project areas which attracts the court restrictions for mining operations, should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the TNPCB (or) Dept. of Geology and Mining should be secured and furnished to the effect that the proposed mining activities could be considered	Not Applicable. Project area / Study area is not declared in ‘Critically Polluted’ Area and does not come under ‘Aravalli Range.
32	Description of water conservation measures proposed to be adopted in the Project should be	Mine Closure in Chapter -2

	given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	
33	Impact on local transport infrastructure due to the Project should be indicated.	Transportation details mentioned in Chapter -2
34	A tree survey study shall be carried out (nos., name of the species, age, diameter etc both within the mining lease applied area & 300m buffer zone and its management during mining activity	Details of the trees in the buffer zone given in Chapter No.3.
35	A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific	Mine closure plan is detailed in Chapter:4
36	Public Hearing points raised and commitments of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project and to be submitted to SEIAA"/SEAC with regard to the office Memorandum of MoEF& CC accordingly	Noted and agreed
37	The Public hearing advertisement shall be published in one major National daily and one most circulated vemacular daily	Noted and agreed
38	The PP shall produce/display the EIA report' Executive summery and other related information with respect to public hearing in Tamil Language also'	Noted and agreed
39	As a part of the study of flora and fauna around the vicinity of the proposed site' the EIA coordinator shall strive to educate the local students on the importance of preserving local flora and fauna by involving them in the study' wherever possible	Detailed in Chapter No.4
40	The purpose of Green belt around the project is to capture the fugitive emissions' carbon Sequestration and to attenuate the noise generated, in addition to improving the aesthetics. A wide range of indigenous plant species should be planted as given in the appendix-Iin consultation with the DFO, State Agriculture University' The plant species with dense/moderate canopy of native origin should be chosen Species of small U medium/tall trees alternating with shrubs should be planted in a mixed manner	Species are proposed to plant in the safety barrier as mentioned in the Tor appendix. Proposed species are given in the Chapter No 4
41	Taller/one year old Saplings raised in appropriate size of bags' preferably eco-friendly bags should be planted as per the advice of local forestaut orities/botanist/Horticult urist with regard to site specific choices' The proponent shall earmark the greenbelt area with GPS coordinates all along the boundary of the project site with at least 3 meters wide and in between blocks in an organized manner	No Tress were in the lease area.
42	A Disaster management Plan shall be prepared and included in the EIA./EMP Report for the complete life/lease of the proposed quarry (or) till the end of the lease period.	Disaster management Plan details in Chapter-7

43	A Risk Assessment and management Plan shall be prepared and included in the EIA/EMP Report for the complete life of the proposed quarry (or) till the end of the lease period	A Risk Assessment and management Plan Chapter- 7
ADDITIONAL CONDITIONS		
1	Cluster Management Committee shall be framed which must include all the proponents in the cluster as members including the existing as well as proposed quarry.	Noted and agreed
2	The members must coordinate among themselves for the effective implementation of EMP as committed including Green Belt Development, Water sprinkling, tree plantation, blasting etc.,	Noted and agreed
3	The List of members of the committee formed shall be submitted to AD/Mines before the execution of mining lease and the same shall be updated every year to the AD/Mines	Noted and agreed
4	Detailed Operational Plan must be submitted which must include the blasting frequency with respect to the nearby quarry situated in the cluster, the usage ofhaul roads by the individual Quarry in the form of route map and network.	Noted and agreed
5	The committee shall deliberate on risk management plan pertaining to the cluster in a holistic manner especially during natural calamities like intense rain and the mitigation measures considering the inundation of the cluster and evacuation plan	A Risk Assessment and management Plan Chapter- 7
6	Mining in a scientific and systematic manner in accordance with the law. The role played by the committee in implementing the environmental policy devised shall be given in detail.	Noted and agreed
7	The committee shall furnish action plan regarding the restoration strategy with respect to the individual quarry falling under the cluster in a holistic manner	Noted and agreed
8	The committee shall furnish the Emergency Management plan within the cluster.	A Risk Assessment and management Plan Chapter- 7
9	The committee shall deliberate on the health of the worker/staff involved in the mining as well as the health ofthe public.	Detailed under Chapter 10.
10	The committee shall furnish an action plan to achieve sustainable development goals with reference to water, sanitation & safety.	Noted and agreed
11	The committee shall furnish the fire safety and evacuation plan in the case of fire accidents.	A Risk Assessment and management Plan Chapter- 7
12	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area covering the entire mine lease period as per precise area communication order issued fiom reputed research institutions on the following	Species Recommended for Plantation in chapter 3&10.

	a) Soil health & soil biological, physical land chemical features . b) Climate change leading to Droughts, Floods etc. c) Pollution leading to release of Greenhouse gases (GHG), rise in Temperature, & Livelihood of the local people. d) Possibilities of water contamination and impact on aquatic ecosystem health e) Agriculture, Forestry & Traditional practices. f) Hydrothermal/Geothermal effect due to destruction in the Environment. g) Bio-geochemical processes and its foot prints including environmental stress. h) Sediment geochemistry in the surface streams	
Agriculture & Agro-Biodiversity		
13	Impact on surrounding agricultural fields around the proposed mining Area.	Detailed discussed in chapter 4.
14	Impact on soil flora & vegetation around the project site.	Detailed discussed in chapter 4.
15	Details of type of vegetations including no. of trees & shrubs within the proposed mining area And If so, transplantation of such vegetations all along the boundary of the proposed mining area shall committed mentioned in EMP.	Details in Chapter 2,3 and 7
16	The Environmental Impact Assessment should study the biodiversity, the natural ecosystem, the soil micro flora fauna and soil seed banks and suggest measures to maintain the natural Ecosystem.	Details in Chapter 3
17	Action should specifically suggest for sustainable management of the area and restoration of ecosystem for flow of goods and services.	Noted & agreed
18	The project proponent shall study and furnish the impact of project on plantations in adjoining pafta lands, Horticulture, Agriculture and livestock.	The project area is bounded by Existing quarries on the west side.
Forests		
19	The project proponent shall detailed study on impact of mining on Reserve forests free ranging wildlife.	Noted and agreed, there is no reserve forest and wildlife in the 1km radius.
20	The Environmental impact Assessment should study impact on forest, vegetation, endemic, Vulnerable and endangered indigenous flora and fauna.	Ecology and Biodiversity environment deals in Chapter-3
21	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection	Ecology and Biodiversity environment deals in Chapter-3

22	The Environmental Impact Assessment should study impact on protected areas, Reserve Forests, National Parks, Corridors and Wildlife pathways, near project site	Anticipated Environment Impact and Mitigation measures are detailed in Chapter No.4
	Water Environment	
23	Hydro-geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within I km (radius) so as to assess the impacts on the nearby water bodies due to Mining activity. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided, covering the entire mine lease period	Hydro-geological study considering the contour map of the water table detailing Chapter-3
24	Erosion Control measures	Noted & agreed
25	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area on the nearby Villages, Water-bodies/ Rivers, & any ecological fragile areas	Details in Chapter 2
26	The project proponent shall study impact on fish habitats and the food WEB/ food chain in the Water body and Reservoir.	Details in Chapter 2 and 4 impact of bio diversity
27	The project proponent shall study and furnish the details on potential &fragmentation impact on natural environment, by the activities	Noted & agreed
28	The project proponent shall study and furnish the impact on aquatic plants and animals in water bodies and possible scars on the landscape, damages to nearby caves, heritage site, and archaeological sites possible land form changes visual and aesthetic impacts.	Noted & agreed. Detailed under Chapter 3.
29	The Terms of Reference should specifically study impact on soil health, soil erosion, the soil Physical, chemical components and microbial components.	Details in Chapter 3 soil environment.
30	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, Lakes and farmer sites.	Noted & agreed
	Energy	
31	The measures taken to control Noise, Air, water, Dust control and steps adopted to efficiently utilise the Energy shall be furnished.	Details in Chapter 4 environmental monitoring details.
	Climate Change	
32	The Environmental Impact Assessment shall study in detail the carbon emission and also suggest the measures to mitigate carbon emission including development of carbon sinks and temperature reduction including control of other emission and climate mitigation activities	Details of carbon emission and mitigation activities are given int the Chapter No.4
33	The Environmental impact Assessment should study impact on climate change, temperature rise, pollution and above soil & below soil carbon stock	Details in Chapter-3 for metorological and climate/weather data representation of graphs.
	Mine Closure PIan	

34	Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued	Details in Chapter 2 mine closure plan
	EMP	
35	Detailed Environment Management Plan along with adaptation. mitigation & remedial strategies covering the entire mine lease period as per precise area communication order issued.	Detailed under Chapter 10
36	The Environmental impact Assessment should hold detailed study on EMP with budget for Green belt development and mine closure plan including disaster management plan'	Details in Green belt development in chapter 4
	Risk Assessment	
37	To furnish risk assessment and management plan including anticipated vulnerabilities during Operational and post operational phases of Mining.	Details study of Risk Assessment Plan in Chapter -7
	Disaster Manasement Plan	
38	To furnish disaster management plan and disaster mitigation measures in regard to all aspects to avoid/reduce vulnerability to hazards & to cope with disaster/untoward accidents in & around the proposed mine lease area due to the proposed method of mining activity & its related activities covering the entire mine lease period as per precise area communication order issued.	Details study of Disaster Management Plan in Chapter -7
	Others	
39	The project proponent shall furnish VAO certificate with reference to 300m radius regard to approved habitations, schools, Archaeological sites, structures, railway lines, roads, water bodies such as streams, odai, vaari, canal, channel, river' lake pond' tank etc'	Noted & agreed. Detailed under Chapter 4
40	As per the MoEF& CC office memorandum F.No.22-65l2017-lA.lll dated: 30.09.2020 and 20.10.2020 the proponent shall address the concerns raised during the public consultation and all the activities proposed shall be part of the Environment Management Plan	Noted and agreed
41	The project proponent shall study and furnish the possible pollution due to plastic and micro plastic on the environment. The ecological risks and impacts of plastic & micro plastics on aquatic environment and fresh water systems due to activities. Contemplated during mining may be investigated and reported.	Details of carbon emission and mitigation activities are given int the Chapter No.4

P2 – Tvl. Thirupathi Blue Metal & M. Sand

"ToR issued vide Letter No. SEIAA-TN/F.No.9668 /ToR-1351/2022 Dated:16.02.2023"

1)	The proponent is requested to carry out a survey and enumerate on the structures located within 50m, 100m, 150m, 200m, 250m, 300m and 500m from the boundary of the mine lease area.	No, structures in 50m. 100m, 150m, 200m, 250m, 300m from the boundary of the mine lease area.

2)	The proponent shall discuss the funds for mitigation measures to be included in the EMP.	Detailed in Chapter No.10
3)	The proponent shall adhere to the bench height - 5m as stated in the approved mining plan	Noted & Agreed
4)	The proponent shall obtain Anna University Star rating system	Noted & Agreed
5)	There is a water body of about 260m, hence the PP shall study about effect of mining nearby the water body in the EIA report.	Detailed in Chapter No.4 in Water environment.
6)	The PP shall furnish justification for mining up to a depth of 55m in the EIA Report	Mining process is restricted upto depth of 45m bgl
7)	The Project Proponent shall conduct the hydro-geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within I km (radius) along with the collected water level data for both monsoon and non-monsoon seasons from the PWD / TWAD so as to assess the impacts on the wells due to mining activity. Necessary data and documentation in this regard may be provided.	Details of hydro geological study in Chapter No. 3
8)	The proponent shall submit the details regarding the controlled blasting activities to be carried out in the proposed quarry indicating the impacts on the surrounding environmental settings includes the structures	Detailed in Chapter No.2
9)	The PP shall provide individual notice regarding the Public Hearing to the nearby house owners located in the vicinity of the project site	Noted and agreed
10)	In the case of proposed lease in an existing (or old) quarry where the benches are non-existent (or) partially formed critical of the bench geometry approved in the Mining Plan, the Project Proponent (PP) shall prepare and submit an 'Action Plan' for carrying out the realignment of the 'high wall' benches to ensure slope stability in the proposed quarry lease which shall be vetted by the concerned Asst. Director of Geology and Mining, during the time of appraisal for obtaining the EC	Noted and agreed
11)	The PP shall furnish the affidavit stating that the blasting operation in the proposed quarry is carried out by the statutory competent person as per the MMR 196l such as blaster, mining mate, mine foreman, IVI Class mines manager appointed by the proponent.	Noted and agreed
12)	Since the quarry lies in a cluster situation, the PP shall furnish a Standard Operating Procedure for carrying out the safe blasting operation while considering the adjacent quarries lies in a radial distance of500 m from their quarry	Noted and agreed
13)	Details of Green belt & fencing shall be included in the EIA Report.	Detailed of Green belt under Chapter 4.
14)	The EIA Coordinators shall obtain and furnish the details of quarry/quarries operated by the proponent in the past, either in the same location or elsewhere in the State with video and photographic evidences	Noted and agreed
15)	If the proponent has already carried out the mining activity in the proposed mining lease area after 15.01.2016, then the proponent shall furnish the following details from AD/DD, mines,	It is a fresh Quarry

	• What was the period of the operation and stoppage of the earlier mines with last work permit issued by the AD/DD mines? • Quantity of minerals mined out. • Highest production achieved in any one year • Detail of approved depth of mining. • . Actual depth of the mining achieved earlier. • Name of the person already mined in that leases area. • IfEC and CTO already obtaine4 the copy of the same shall be submitted. • Whether the mining was carried out as per the approved mine plan (or EC if issued) with stipulated benches	
16)	All corner coordinates of the mint lease area. superimposed on a High Resolution Imagery/Topo sheet, topographic sheet. geomorphology. Ethology and geology of the mining lease area should be provided. Such an Imagers of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Satellite imagery of the project area along with boundary coordinates is given in the Chapter No 1 Geomorphology of the area is given in Chapter No 2 Land use pattern of the project area is tabulated in the Chapter No.2. Land use pattern of the Study area is tabulated in the Chapter No.3
17)	The PP shall carry out Drone video survey covering the cluster. Green belt & fencing etc	Drone video covering the cluster area clearly stating the extent of the operation will be submitted in the final EIA report
18)	The proponent shall furnish photographs of adequate fencing. green belt along the periphery including replantation of existing trees & safety distance between the adjacent quarries & water bodies nearby provided as per the approved mining plan.	Noted and agreed
19)	The Project Proponent shall provide the details of mineral reserves and mineable reserves, planned production capacity. proposed working methodology with justifications. the anticipated impacts of the mining operations on the surrounding environment and the remedial measures for the same	Total Mineable Reserves, Proposed production and working methodology given in the Chapter No.2
20)	The Project Proponent shall provide the Organisation chart indicating the appointment of various statutory officials and other competent persons to be appointed as per the provisions of Mines Act'1952 and the MMR, 1961 for carrying out the quarrying operations scientifically and systematically in order to ensure safety and to protect the environment.	Organization chart indicating Proposal for the appointment of Statutory officials is given in the Chapter No.7
21)	The proponent shall furnish the baseline data for the environmental and ecological parameters with regard to surface water/ground water quality, air quality, soil quality & flora/fauna including traffic/vehicular movement study	Baseline Data were collected for One Season (Pre-Monsoon) March to May 2023 as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3
22)	The Proponent shall carry out the Cumulative impact study due to mining operations carried out in the quarry specifically with reference to the specific environment in terms of soil health	The Cumulative impact study due to mining operations is explained in chapter – 7
23)	Rain water harvesting management with recharging details along with water balance (both monsoon & non-monsoon) be submitted	Noted and agreed

24)	Land use of the study area delineating forest are agricultural land, grazing land, wildlife sanctuary, national park, minatory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Noted and agreed
25)	Details of the land for storage of Overburden/Waste Dumps (or) Rejects outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be provided.	Not applicable. No waste is anticipitated in the lease area.
26)	Proximity to Areas declared as 'Critically Polluted' (or) the Project areas which attracts the court restrictions for mining operations, should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the TNPCB (or) Dept. of Geology and Mining should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.
27)	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rain water harvesting proposed in the Project, if any, should be provided	Mine Closure in Chapter -2
28)	impact on local transport infrastructure due to the Project should be indicated.	Transportation details mentioned in Chapter -2
29)	A tree survey study shall be carried out (nos., name of the species, age, diameter etc both within the mining lease applied area & 300m buffer zone and its management during mining activity.	Details of the trees in the buffer zone given in Chapter No.3.
30)	A detailed mine closure plan for the proposed project shall be included in EIA/EMP report which should be site-specific	Mine closure plan is detailed in Chapter:4
31)	Public Hearing points raised and commitments of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EL{/EMP Report of the Project and to be submitted to SEIAA/SEAC with regard to the Office Memorandum of MoEF& CC accordingly.	Noted and agreed
32)	The Public hearing advertisement shall be published in one major National daily and one most circulated vernacular daily	Noted and agreed
33)	The PP shall produce/display the EIA report, Executive summery and other related information with respect to public hearing in Tamil Language also.	Noted and agreed
34)	As a part of the study of flora and fauna around the vicinity of the proposed site, the EIA coordinator shall strive to educate the local students on the importance of preserving local flora and fauna by involving them in the study, wherever possible	Detailed in Chapter No.3.
35)	The purpose of Green belt around the project is to capture the fugitive emissions, carbon sequestration and to attenuate the noise	Species are proposed to plant in the safety barrier as mentioned in the Tor appendix. Proposed species are given in the Chapter No 4

	generated, in addition to improving the aesthetics. A wide range of indigenous plant species should be planted as given in the appendix-lin consultation with the DFO, State Agriculture University. The plant species with dense/moderate canopy of native origin should be chosen. Species of small/medium/tall trees alternating with shrubs should be planted in a mixed manner.	
36)	Taller/one year old Saplings raised in appropriate size of bags' preferably eco-friendly bags should be planted as per the advice of local forestaut orities/botanist/Horticult urist with regard to site specific choices' The proponent shall earmark the greenbelt area with GPS coordinates all along the boundary of the project site with at least 3 meters wide and in between blocks in an organized manner.	No Tress were in the lease area.
37)	A Disaster management Plan shall be prepared and included in the EIA./EMP Report for the complete life of the proposed quarry (or) till the end of the lease period	Disaster management Plan details in Chapter-7
38)	A Risk Assessment and management Plan shall be prepared and included in the EIA,/EMP Report for the complete life of the proposed quarry (or) till the end of the lease period'	A Risk Assessment and management Plan Chapter- 7
39)	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational Health impacts chapter- 10
40)	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations	It is explained in Chapter -3
41)	The Socio-economic studies should be carried out within a 5 km buffer zone from the mining activity. Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation	Details are listed in Chapter:3.
42)	Details of litigation pending against the project, if any, with direction order passed by any court Of Law against the Project should be given.	No Litigation is pending
43)	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Noted and agreed
44)	If any quarrying operations were carried out in the proposed quarrying site for which now the EC is sought, the Project Proponent shall furnish the detailed compliance to EC conditions given in the previous EC with the site photographs which shall duly be certified by MoEF &CC, Regional	It is a fresh quarry

	Office, Chennai (or) the concerned DEE/TNPCB	
45)	The PP shall prepare the EMP for the entire life of mine and also furnish the swum affidavit stating to abide the EMP for the entire life of mine.	Detailed in Chapter No. 10
46)	Concealing any factual information or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this Terms of Conditions besides attracting penal provisions in the Environment (Protection) Act, 1986	Noted and agreed
ADDITIONAL CONDITIONS		
1	Cluster Management Committee shall be framed which must include all the proponents in the cluster as members including the existing as well as proposed quarry.	Noted and agreed
2	The members must coordinate among themselves for the effective implementation of EMP as committed including Green Belt Development, Water sprinkling, tree plantation, blasting etc.,	Noted and agreed
3	The List of members of the committee formed shall be submitted to AD/Mines before the execution of mining lease and the same shall be updated every year to the AD/Mines	Noted and agreed
4	Detailed Operational Plan must be submitted which must include the blasting frequency with respect to the nearby quarry situated in the cluster, the usage ofhaul roads by the individual Quarry in the form of route map and network.	Noted and agreed
5	The committee shall deliberate on risk management plan pertaining to the cluster in a holistic manner especially during natural calamities like intense rain and the mitigation measures considering the inundation of the cluster and evacuation plan	A Risk Assessment and management Plan Chapter- 7
6	Mining in a scientific and systematic manner in accordance with the law. The role played by the committee in implementing the environmental policy devised shall be given in detail.	Noted and agreed
7	The committee shall furnish action plan regarding the restoration strategy with respect to the individual quarry falling under the cluster in a holistic manner	Noted and agreed
8	The committee shall furnish the Emergency Management plan within the cluster.	A Risk Assessment and management Plan Chapter- 7
9	The committee shall deliberate on the health of the worker/staff involved in the mining as well as the health ofthe public.	Detailed under Chapter 10.
10	The committee shall furnish an action plan to achieve sustainable development goals with reference to water, sanitation & safety.	Noted and agreed
11	The committee shall furnish the fire safety and evacuation plan in the case of fire accidents.	A Risk Assessment and management Plan Chapter- 7
12	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area covering the entire mine lease period as per precise area	Species Recommended for Plantation in chapter 3&10.

	communication order issued fiom reputed research institutions on the following a) Soil health & soil biological, physical land chemical features . b) Climate change leading to Droughts, Floods etc. c) Pollution leading to release of Greenhouse gases (GHG), rise in Temperature, & Livelihood of the local people. d) Possibilities of water contamination and impact on aquatic ecosystem health e) Agriculture, Forestry & Traditional practices. f) Hydrothermal/Geothermal effect due to destruction in the Environment. g) Bio-geochemical processes and its foot prints including environmental stress. h) Sediment geochemistry in the surface streams	
	Agriculture & Agro-Biodiversity	
13	Impact on surrounding agricultural fields around the proposed mining Area.	Detailed discussed in chapter 4.
14	Impact on soil flora & vegetation around the project site.	Detailed discussed in chapter 4.
15	Details of type of vegetations including no. of trees & shrubs within the proposed mining area And If so, transplantation of such vegetations all along the boundary of the proposed mining area shall committed mentioned in EMP.	Details in Chapter 2,3 and 7
16	The Environmental Impact Assessment should study the biodiversity, the natural ecosystem, the soil micro flora fauna and soil seed banks and suggest measures to maintain the natural Ecosystem.	Details in Chapter 3
17	Action should specifically suggest for sustainable management of the area and restoration of ecosystem for flow of goods and services.	Noted & agreed
18	The project proponent shall study and furnish the impact of project on plantations in adjoining pafta lands, Horticulture, Agriculture and livestock.	The project area is bounded by Existing quarries on the west side.
	Forests	
19	The project proponent shall detailed study on impact of mining on Reserve forests free ranging wildlife.	Noted and agreed, there is no reserve forest and wildlife in the 1km radius.
20	The Environmental impact Assessment should study impact on forest, vegetation, endemic, Vulnerable and endangered indigenous flora and fauna.	Ecology and Biodiversity environment deals in Chapter-3
21	The Environmental Impact Assessment should study impact on standing trees and the existing trees should be numbered and action suggested for protection	Ecology and Biodiversity environment deals in Chapter-3
22	The Environmental Impact Assessment should study impact on protected areas, Reserve Forests, National	Anticipated Environment Impact and Mitigation measures are detailed in Chapter No.4

	Parks, Corridors and Wildlife pathways, near project site	
	Water Environment	
23	Hydro-geological study considering the contour map of the water table detailing the number of ground water pumping & open wells, and surface water bodies such as rivers, tanks, canals, ponds etc. within I km (radius) so as to assess the impacts on the nearby water bodies due to Mining activity. Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided, covering the entire mine lease period	Hydro-geological study considering the contour map of the water table detailing Chapter-3
24	Erosion Control measures	Noted & agreed
25	Detailed study shall be carried out in regard to impact of mining around the proposed mine lease area on the nearby Villages, Water-bodies/ Rivers, & any ecological fragile areas	Details in Chapter 2
26	The project proponent shall study impact on fish habitats and the food WEB/ food chain in the Water body and Reservoir.	Details in Chapter 2 and 4 impact of bio diversity
27	The project proponent shall study and furnish the details on potential &fragmentation impact on natural environment, by the activities	Noted & agreed
28	The project proponent shall study and furnish the impact on aquatic plants and animals in water bodies and possible scars on the landscape, damages to nearby caves, heritage site, and archaeological sites possible land form changes visual and aesthetic impacts.	Noted & agreed. Detailed under Chapter 3.
29	The Terms of Reference should specifically study impact on soil health, soil erosion, the soil Physical, chemical components and microbial components.	Details in Chapter 3 soil environment.
30	The Environmental Impact Assessment should study on wetlands, water bodies, rivers streams, Lakes and farmer sites.	Noted & agreed
	Energy	
31	The measures taken to control Noise, Air, water, Dust control and steps adopted to efficiently utilise the Energy shall be furnished.	Details in Chapter 4 environmental monitoring details.
	Climate Change	
32	The Environmental Impact Assessment shall study in detail the carbon emission and also suggest the measures to mitigate carbon emission including development of carbon sinks and temperature reduction including control of other emission and climate mitigation activities	Details of carbon emission and mitigation activities are given int the Chapter No.4
33	The Environmental impact Assessment should study impact on climate change, temperature rise, pollution and above soil & below soil carbon stock	Details in Chapter-3 for metorological and climate/weather data representation of graphs.
	Mine Closure PIan	
34	Detailed Mine Closure Plan covering the entire mine lease period as per precise area communication order issued	Details in Chapter 2 mine closure plan
	EMP	

35	Detailed Environment Management Plan along with adaptation. mitigation & remedial strategies covering the entire mine lease period as per precise area communication order issued.	Detailed under Chapter 10
36	The Environmental impact Assessment should hold detailed study on EMP with budget for Green belt development and mine closure plan including disaster management plan'	Details in Green belt development in chapter 4
	Risk Assessment	
37	To furnish risk assessment and management plan including anticipated vulnerabilities during Operational and post operational phases of Mining.	Details study of Risk Assessment Plan in Chapter -7
	Disaster Manasement Plan	
38	To furnish disaster management plan and disaster mitigation measures in regard to all aspects to avoid/reduce vulnerability to hazards & to cope with disaster/untoward accidents in & around the proposed mine lease area due to the proposed method of mining activity & its related activities covering the entire mine lease period as per precise area communication order issued.	Details study of Disaster Management Plan in Chapter -7
	Others	
39	The project proponent shall furnish VAO certificate with reference to 300m radius regard to approved habitations, schools, Archaeological sites, structures, railway lines, roads, water bodies such as streams, odai, vaari, canal, channel, river' lake pond' tank etc'	Noted & agreed. Detailed under Chapter 4
40	As per the MoEF& CC office memorandum F.No.22-65l2017-lA.lll dated: 30.09.2020 and 20.10.2020 the proponent shall address the concerns raised during the public consultation and all the activities proposed shall be part of the Environment Management Plan	Noted and agreed
41	The project proponent shall study and furnish the possible pollution due to plastic and micro plastic on the environment. The ecological risks and impacts of plastic & micro plastics on aquatic environment and fresh water systems due to activities. Contemplated during mining may be investigated and reported.	Details of carbon emission and mitigation activities are given int the Chapter No.4

	STANDARD TERMS OF REFERENCE	
1	Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.	**Not applicable.** The project is Not a violation category. This proposal falls under B1 Category (Cluster situation)
2	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	Document is enclosed along with Approved Mining Plan as Annexure Volume 1 for the respective projects.
3	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	**Noted & agreed.**

4	All corner coordinates of the mine lease area, superimposed on a High-Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	Satellite imagery of the project area along with boundary co-ordinates is given in the Chapter No 1 Figure No .1.1 Geomorphology of the area is given in Chapter No 2 Figure No 2.10. Land use pattern of the project area is tabulated in the Chapter No.2. Table No.2.3 Land use pattern of the Study area is tabulated in the Chapter No.3 Table No 3.2
5	Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	**Map showing –** Geology map of the project area covering 10km radius - Figure No. 2.11. Geomorphology of the area is given in Chapter No 2 Figure No 2.10.
6	Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	The applied area was inspected by the officers of Department of Geology along with revenue officials and found that the land is fit for quarrying under the policy of State Government.
7	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/ violation of the environmental or forest norms/conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.	The proponent has framed their Environmental Policy and the same is discussed in the Chapter No 10.1.
8	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	It is an opencast quarrying operation proposed to operate in Mechanized method. The rough stone formation is a hard, compact and homogeneous body. The height and width of the bench will be maintained as 5m with 90^0 bench angles. Quarrying activities will be carried out under the supervision of Competent Persons like Mines Manager, Mines Foreman and Mining Mate. Necessary permissions will be obtained from DGMS after obtaining Environmental Clearance.
9	The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc., should be for the life of the mine / lease period.	**Noted & agreed.** The study area considered for this study is 10 km radius and all data contained in the EIA report such as waste generation etc., is for the Life of the Mine / lease period.
10	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use and land cover of the study area is discussed in Chapter No. 3. Land use plan of the project area showing pre-operational, operational and post-operational phases are discussed in Chapter No. 2, Table No 2.3.
11	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area,	**Not Applicable.**

	distance from mine lease, its land use, R&R issues, if any, should be given	There is no waste anticipated during this quarry operation. The entire quarried out rough stone will be transported to the needy customers. No Dumps is proposed outside the lease area.
12	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.	**Not Applicable.** There is no Forest Land involved in the proposed project area. The proposed project area is a patta land. Approved Mining Plan is enclosed as Annexure Volume 1.
13	Status of forestry clearance for the broken-up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.	**Not Applicable.** The proposed project area does not involve any Forest Land.
14	Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.	**Not Applicable.** The project doesn't attract Recognition of Forest Rights Act, 2006.
15	The vegetation in the RF/PF areas in the study area, with necessary details, should be given.	No Reserve Forest within the Study Area.
16	A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.	**Not Applicable.** There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
17	Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10 KM of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished	**Not Applicable.** There are No National Parks, Biosphere Reserves, Wildlife Corridors, and Tiger/Elephant Reserves within 10 km Radius from the periphery of the project area.
18	A detailed biological study of the study area [core zone and buffer zone (10 KM radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	Detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] was carried out and discussed under Chapter No. 3. There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. Detailed in Chapter No. 3.

19	Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravalli Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered.	**Not Applicable.** Project area / Study area is not declared in 'Critically Polluted' Area and does not come under 'Aravalli Range.
20	Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL. HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	**Not Applicable.** The project doesn't attract The C. R. Z. Notification, 2018.
21	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need-based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.	**Not Applicable.** There are no approved habitations within a radius of 300 meters. Therefore, R&R Plan / Compensation details for the Project Affected People (PAP) is not anticipated and Not Applicable for this project.
22	One season (non-monsoon) [i.e. March-May (Summer Season); October-December (post monsoon season); December-February (winter season)] primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.	Baseline Data were collected for One Season Mar 2023 - May 2023 (Summer Season) as per CPCB Notification and MoEF & CC Guidelines. Details in Chapter No. 3.
23	Air quality modelling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modelling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.	Air Quality Modelling for prediction of incremental GLC's of pollutant was carried out using AERMOD view 9.6.1 Model. Details in Chapter No. 4.

24	The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.	Total Water Requirement for this project is given in the chapter No 2, Table No 2.13.
25	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.	Water for dust suppression, greenbelt development and domestic use will be obtained from accumulated rainwater/seepage water in mine pits. Drinking water will be sourced from the approved water vendors, No 2, Table No 2.13.
26	Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.	The rain water collected in the pits after spell of rain will be used for greenbelt development and dust suppression.
27	Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.	Impact Studies and Mitigation Measures of Water Quality discussed in Chapter No. 4.
28	Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.	The ground water table is at 65-68m below ground level. In these projects, ultimate depth is 45m Maximum from the general ground profile. It is inferred the quarrying activities in the Cumulative EIA project (Quarry) will not intersect the Ground water table.
29	Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.	Highest elevation of the project area is 100m AMSL Ultimate depth of the mine is 45m AMSL Water level in the area is 68m BGL to 65m BGL
30	Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and BGL. A schematic diagram may also be provided for the same.	Progressive greenbelt development plan has been prepared and discussed along with Recommended Species details are given in the Chapter 4, Table No.4.12
31	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.	Traffic density survey was carried out to analyse the impact of Transportation in the study area as per IRC guidelines 1961 and it is inferred that there is no much significant impact due to the proposed transportation from the project area. Details in Chapter 2.
32	Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be	Infrastructure & other facilities will be provided to the Mine Workers after the grant of quarry lease and the same has been discussed in the Chapter No.2.

	covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.	
33	Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.	Discussed in chapter No 2.
34	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Details in Chapter 10.
35	Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	Occupational health impact and details of the medical examination to the workers given in the Details in Chapter 10.
36	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	Details in Chapter No. 4
37	Measures of socio-economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Details of Socio Economic is given in the Chapter No 3.
38	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Environment Management Plan Chapter 10.
39	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	Public hearing points and commitment of the project proponent will be updated in the final EIA & EMP Report.
40	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	No litigation is pending in any court against this project.
41	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Project Cost is given in the Chpater No 2, Table No 2.15.
42	A Disaster management Plan shall be prepared and included in the EIA/EMP Report.	Detailed under Chapter 7
43	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.	Total Water Requirement for this project is given in the chapter No 2, Table No 2.13.
44	**Besides the above, the below mentioned general points are also to be followed: -**	
A	Executive Summary of the EIA/EMP Report	Encloses as separate volume
B	All documents to be properly referenced with index and continuous page numbering.	All the documents are properly referenced with index and continuous page numbering.
C	Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.	List of Tables and source of the data collected are given properly.

D	Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF & CC / NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project	Copy of Baseline monitoring reports are enclosed with this draft as annexure
E	Where the documents provided are in a language other than English, an English translation should be provided.	Not Applicable.
F	The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.	Questionnaire of the project will be submitted in final EIA report after complying the public hearing points.
G	While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF & CC vide O.M. No. J-11013/41/2006-IA.II(I) Dated: 4th August, 2009, which are available on the website of this Ministry, should be followed.	Instructions issued by MoEF & CC O.M. No. J-11013/41/2006-IA. II (I) Dated: 4th August, 2009 are followed.
H	Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF & CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation	There is no changes in Form-I, Mining plan and Pre-feasibility report for all the projects.
I	As per the circular no. J-11011/618/2010-IA. II(I) Dated: 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Not applicable.
J	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Satellite imagery of the project area along with boundary co ordinates is given in the Chapter No 1 Figure No .1.1 Geomorphology of the area is given in Chapter No 2 Figure No 2.10.

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1. INTRODUCTION

1.0 PREAMBLE

Environmental Impact Assessment (EIA) is the management tool to ensure the sustainable development and it is a process, used to identify the environmental, social and economic impacts of a project prior to decision-making. It is a decision-making tool, which guides the decision makers in taking appropriate decisions for any project. EIA systematically examines both beneficial and adverse consequences of the project and ensures that these impacts are taken into account during the project designing. It also reduces conflicts by promoting community participation, information, decision makers, and helps in developing the base for environmentally sound project.

Rough Stone and Gravel are the major requirements for construction industry. This EIA report is prepared by considering Cumulative load of proposed & existing quarries of Tvl.Thirupathi Blue metals & M. sand Rough Stone and Gravel Cluster Quarry consisting of Two Proposed and Two Existing Quarries with total extent of Cluster of **17.64.55 Ha** in Enthoor Village, Marakkanam Taluk, Viluppuram District and Tamil Nadu State, cluster area calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016.

This EIA Draft is prepared in compliance with ToR obtained vide:

P1 - Lr.No. SEIAA-TN/F.No.9534/ ToR-1347/2022 Dated: 10.02.2023

P2 - Lr.No. SEIAA-TN/F.No.9668/ToR/1351/2022 Dated: 16.02.2023

The Baseline Monitoring study has been carried out during Pre Moonsoon season (March 2023 to May 2023) and the Cumulative Environmental Impact Assessment study is undertaken, which is followed by preparation of a detailed Environmental Management Plan (EMP) individually to minimize those adverse impacts.

1.1 PURPOSE OF THE REPORT

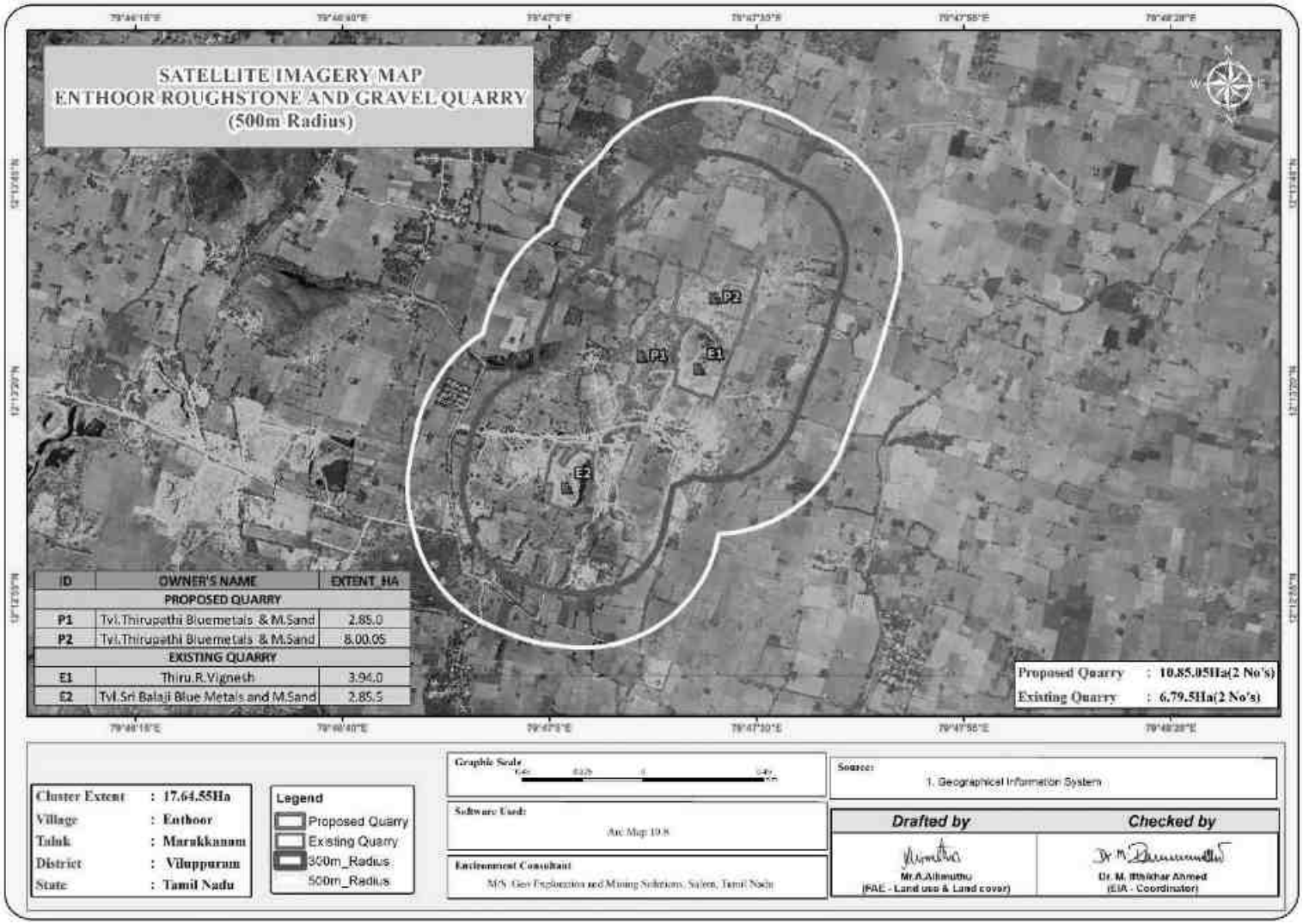
The Ministry of Environment and Forests, Govt. of India, through its EIA notification S.O. 1533 (E) of 14th September 2006 and its subsequent amendments as per Gazette Notification S.O. 3977 (E) of 14th August 2018, Mining Projects are classified under two categories i.e. A (> 100 Ha) and B (≤ 100 Ha), and Schematic Presentation of Requirements on Environmental Clearance of Minor Minerals including cluster situation in Appendix–XI.

Now, as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018 clarified the requirement for EIA, EMP and therefore, Public Consultation for all areas from 5 to 25 ha falling in Category B1 and appraised by SEAC/ SEIAA as well as for cluster situation.

The proposed projects are categorized under category "B1" Activity 1(a) (mining lease area in cluster situation) and will be considered at SEIAA – TN after conducting Public Hearing and Submission of EIA/EMP Report for Grant of Environmental Clearance.

"Draft EIA report prepared on the basis of ToR Issued for carrying out public hearing for the grant of Environmental Clearance from SEIAA, Tamil Nadu"

FIGURE 1.1 SATELLITE IMAGERY CLUSTER QUARRIES



1.2 IDENTIFICATION OF PROJECT AND PROJECT PROPONENTS

1.2.1 Identification of Project

TABLE 1.1: SALIENT FEATURES OF THE PROPOSED PROJECT

Project	P1	P2
Name of the Project	Tvl Thirupathi Blue Metals & M.sand Rough Stone & Gravel	Tvl Thirupathi Blue Metals & M.sand Rough Stone & Gravel
S.F. No.	6/1,7/2,3,4	2/1B,2,3(P),5,3,4/1,2
Extent	2.85.0	8.00.05 ha
Land Type	Patta Land	Patta Land
Village ,Taluk and District	Enthoor Village, Marakkanam Taluk, Viluppuram District	

Source: Approved Mining Plan

1.2.2 Identification of Project Proponent

TABLE 1.2: DETAILS OF PROJECT PROPONENT

Name of the Project Proponent	E. Sekar, Managing Partner (Tvl Thirupathi Blue Metals & M.sand)
Address	S/o. Etty, No.32, Bajanai Kovil Street, Natham Kariyacherry Village, Mullikolathur Post, Thirukazhukundram Taluk, Kancheepuram District
Mobile	+91 86088 15555 & 94436 02213
Status	Partnership

Source: Approved Mining Plan

1.3 BRIEF DESCRIPTION OF THE PROJECT

1.3.1 Nature and Size of the Project

The quarrying operation is proposed to be carried out by Opencast Mechanized Mining method with 5.0m bench height and 5.0m bench width by deploying Jack Hammer Drilling & Slurry Explosive during blasting. Hydraulic Excavator and tippers are used for Loading and transportation. Rock Breakers are deployed to avoid secondary blasting.

TABLE 1.3: BRIEF DESCRIPTION OF THE PROJECT-P1

Name of the Project	Tvl. Thirupathi Blue Metal & M. Sand Rough Stone & Gravel Quarry	
Toposheet No	57-P/16	
Latitude between	12^0 13’17.9159” N to $12^0$13’29.3407” N	
Longitude between	79^0 47’13.2559” E to $79^0$47’19.9500” E	
Highest Elevation	100m AMSL	
Proposed Depth of Mining	37 m bgl (2 m topsoil +35m Rough Stone)	
Geological Resources	Rough Stone in m^3	Gravel m^3
	10,01,221	54,758
Mineable Reserves	Rough Stone in m^3	Gravel m^3
	2,61,972	27,878
Yearwise production after bench reduction	Rough Stone in m^3	Gravel m^3
	2,59,242	27,878
Existing pit Dimension	Pit I: 1978 Area in S. qm x 2m (D) Pit II: 558 Area in S. qm x 2m(D) Pit III: 3812 Area in S. qm x 12m(D) Pit IV: 1282 Area in S. qm x 12m(D)	
Previous EC details	It is previously operated by Sri balaji blue metals from 18.04.2013 to 17.04.2018 Lr.No. SEIAA-TN/F.No.767/EC/1(a)/156 dated: 27.03.2013.	
Ultimate Pit Dimension	359m (L) x 105m (W) x 37m (D)	

Water Level measured in the surrounding area	51m-47m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is exhibits almost plain terrain. The area has gentle sloping towards eastern side. The altitude of the area is 100m (max) above mean sea level. The area is covered by 2m thickness of gravel formation. Massive Charnockite is found after 2m of Gravel formation which is clearly inferred from the existing quarrying pit.	
Machinery proposed	Jack Hammer	8 Nos
	Compressor	2 Nos
	Hydraulic Excavator& Rock Breaker	2 Nos
	Tippers	4 Nos
Blasting method and type of Explosives proposed	Controlled Blasting Method by shot hole drilling (30.-32mm dia hole) and small dia of 25mm slurry explosive are proposed to use for winning of Rough Stone. No deep hole drilling is proposed.	
Proposed Manpower Deployment	34 Nos	
Project Cost	Rs.54,37,000/-	
CER Cost	Rs.5,00,000/-	
Nearby Water Bodies	odai	500m_NE
	Tank	260m SW
	Kunnapakkam Lake	800m_E
	Ariyathangal Lake	860m_SW
	Endur Lake	1.3Km_S
	Bramaddesam Lake	3Km_SW
	Munnur Lake	4Km_SE
	Nallavur Lake	8.5Km_SW
	Puthunagara Lake	8.5Km_SW
	Nolambur Lake	6Km_NW
	Kilsevur Lake	4Km_NW
	Ongur Stream	8.5Km_NE
Greenbelt Development Plan	1700 trees will be planned in safety area, approach road and panchayat roads	
Proposed Water Requirement	1.5 KLD	
Nearest Habitation	570m South West	

TABLE 1.3A: BRIEF DESCRIPTION OF THE PROJECT -P2

Name of the Project	Tvl. Thirupathi Blue Metal & M. Sand Rough Stone & Gravel Quarry	
Toposheet No	57-P/16	
Latitude between	12^0 13’24.51” N to $12^0$13’39.076” N	
Longitude between	79^0 47’19.52” E to $79^0$47’30.78” E	
Highest Elevation	100m AMSL	
Proposed Depth as per Mining plan	55m bgl (2m Gravel + 53m Rough Stone)	
Geological Resources	Rough Stone in m^3	Gravel m^3
	42,37,138	1,59,892
Mineable Reserves	Rough Stone in m^3	Gravel m^3
	24,07,748	1,40,744
Yearwise production as per ToR	Rough Stone in m^3	Gravel m^3
	11,55,048	1,40,744
Ultimate Pit Dimension	Pit I: 132m (L) x 196m (W) x 50m (D) Pit II: 186m (L) x 256m (W) x 55m (D)	
Water Level measured in the surrounding area	65m-68m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is plain terrain. The area has gentle sloping towards Southeastern side. The altitude of the area is 100m (max) above mean sea level. The area is covered by 2m thickness of Gravel formation. Massive Charnockite is found after 2m of Gravel formation which is clearly inferred from the existing quarrying pit.	

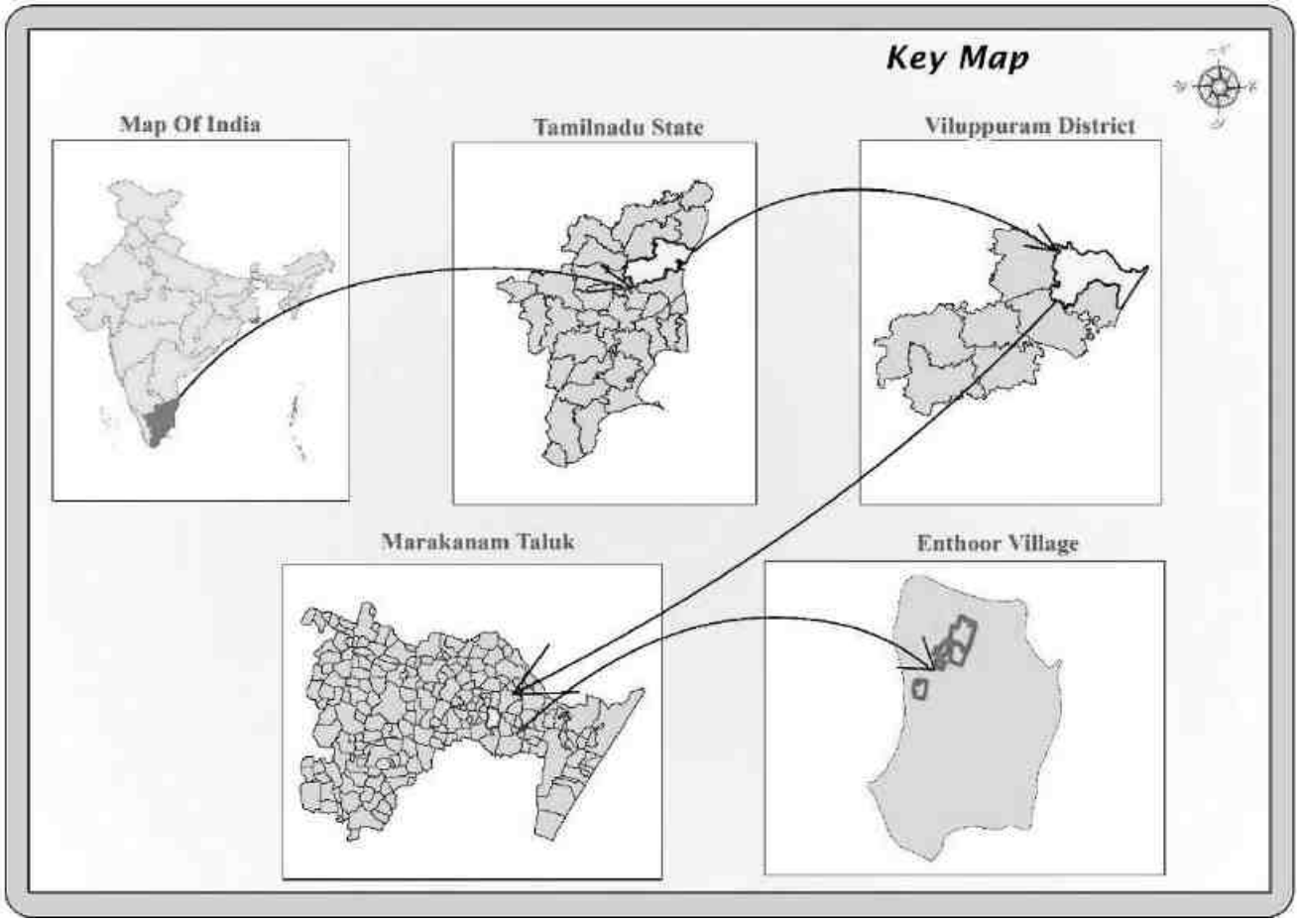
Machinery proposed	Jack Hammer	6 Nos
	Compressor	2 Nos
	Wagon Drill	2 Nos
	Excavator with Bucket and Rock Breaker	2 Nos
	Tippers	8 Nos
Blasting method and type of Explosives proposed	Controlled Blasting Method by shot hole drilling (30.-32mm dia hole) and small dia of 25mm slurry explosive are proposed to use for winning of Rough Stone.	
Proposed Manpower Deployment	48Nos	
Project Cost	Rs. 5,70,44,000/-	
CER Cost	Rs.5,00,000/-	
Nearby Water Bodies	odai	230m E
	Tank	470m SW
	Kunnapakkam Lake	970m SW
	Ariyathangal Lake	1.1Km SW
	Endur Lake	1.5Km S
	Bramaddesam Lake	3.2Km SW
	Munnur Lake	3.8Km SE
	Nallavur Lake	9Km SW
	Puthunagara Lake	9Km SW
	Nolambur Lake	6.3Km NW
	Kilsevur Lake	4.3Km NW
	Ongur Stream	8Km NE
Greenbelt Development Plan	4800 trees will be planned in safety area, approach road and panchayat roads	
Proposed Water Requirement	4.0 KLD	
Nearest Habitation	800m Southwest	

Source: Approved Mining Plan

1.3.2 Location of the Project

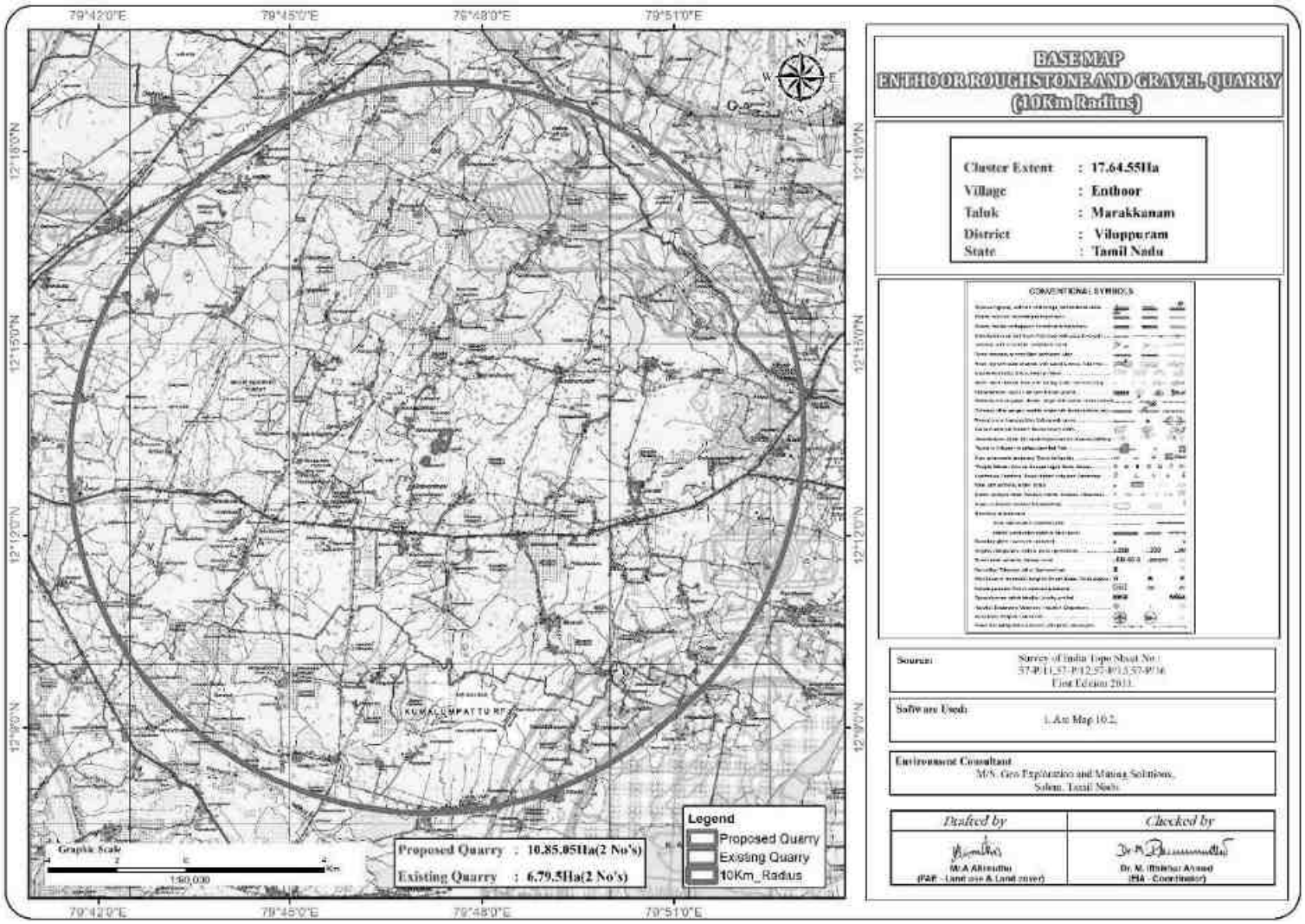
- The Proposed project fall in Enthoor Village, Marakkanam Taluk and Viluppuram District.
- The project is located about 46 km Northeast of Viluppuram town and 15 km Northwest of Marakkanam town and 2.0 km Northwest side of Enthoor Village.

FIGURE 1.2 KEY MAP SHOWING THE LOCATION OF THE CLUSTER SITE



Source: Survey of India Toposheet 57-P/16

FIGURE 1.3: TOPOSHEET MAP OF THE STUDY AREA 10 KM RADIUS



Source:Survey of India Toposheet 57-P/16

1.4 ENVIRONMENTAL CLEARANCE

The Environmental Clearance process for the project will comprise of four stages. These stages in sequential order are given below: -

- Screening,
- Scoping
- Public consultation &
- Appraisal

SCREENING –

PROPOSAL – P1 -

- The proponent applied for Rough Stone Quarry Lease Dated: 16.08.2019.
- Precise Area Communication Letter was issued by the District Collector, Viluppuram Rc.No.B/G7M/678/2019 , Dated: 28.04.2022
- The Mining Plan was prepared by Recognized Qualified Person and approved by Assistant Director, Geology and Mining, Viluppuram District, vide Rc.No.B/G7M/678/2019 , Dated: 24.06.2022.
- The proposed project falls under "B1" Category as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018.
- Proponent applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/402621/2022 Date: 10.10.2022.

PROPOSAL – P2 -

- The proponent applied for Rough Stone Quarry Lease Dated: 29.04.2022.
- Precise Area Communication Letter was issued by the District Collector, Viluppuram Rc.No.B/G&M/164/2022, Dated: 18.10.2022
- The Mining Plan was prepared by Recognized Qualified Person and approved by Assistant Director, Geology and Mining, Viluppuram District, vide Rc.No.B/G&M/164/2022, Dated: 17.11.2022.
- The proposed project falls under "B1" Category as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018
- Proponent applied for ToR for Environmental Clearance vide online Proposal No. SIA/TN/MIN/411373/2022 Date: 20.12.2022.

SCOPING –

PROPOSAL – P1

- The proposal was placed in 346th SEAC meeting held on 12.01.2023 and the committee recommended for issue of ToR.
- The proposal was considered in 591th SEIAA meeting held on 10.02.2023 and issued ToR vide Letter No SEIAA-TN/F.No. 9534/SEAC/ ToR-1347/2022 Dated: 10.02.2023.

PROPOSAL – P2

- The proposal was placed in 347th SEAC meeting held on 13.01.2023 and the committee recommended for issue of ToR.
- The proposal was considered in 592^{h} SEIAA meeting held on 16.02.2023 and issued ToR vide Letter No SEIAA-TN/F.No.9668/SEAC/ToR-1351/2022 Dated: 16.02.2023.

PUBLIC CONSULTATION –

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the district is submitted along with this Draft EIA/ EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

APPRAISAL –

- Appraisal is the detailed scrutiny by the State Expert Appraisal Committee (SEAC) of the application and other documents like the final EIA & EMP Report, outcome of the Public Consultations including Public Hearing Proceedings, submitted by the proponent to the regulatory authority concerned for grant of environmental clearance.
- The report has been prepared using the following references:
- Guidance Manual of Environmental Impact Assessment for Mining of Minerals, Ministry of Environment and Forests, 2010
- EIA Notification, 14th September, 2006
- Letter No SEIAA-TN/F.No.9534/ SEAC/ToR-1347/2022 Dated: 10.02.2023-P1
- Letter No SEIAA-TN/F.No.9668/SEAC/ToR-1351/2022 Dated: 16.02.2023-P2
- Approved Mining Plan of Proposed Projects.

1.5 TERMS OF REFERENCE (ToR)

Compliance to ToR issued vide –

- Letter No SEIAA-TN/F.No.9534/ SEAC/ToR-1347/2022 Dated: 10.02.2023-P1
- Letter No SEIAA-TN/F.No.9668/SEAC/ToR-1351/2022 Dated: 16.02.2023-P2.

(Detailed in above)

1.6 POST ENVIRONMENT CLEARANCE MONITORING

The proposed project proponent shall submit a half-yearly compliance report in respect of stipulated Environmental Clearance terms and conditions to MoEF & CC Regional Office & SEIAA after grant of EC on 1st June and 1st December of each calendar year as per MoEF & CC Notification S.O. 5845 (E) Dated: 26.11.2018.

1.7 GENERIC STRUCTURE OF EIA DOCUMENT

The overall contents of the EIA report follow the list of contents prescribed in the EIA Notification 2006 and the "Environmental Impact Assessment Guidance Manual for Mining of Minerals" published by MoEF & CC.

1.8 THE SCOPE OF THE STUDY

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the Post monsoon season (March 2023 to May 2023) for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suggest suitable mitigation measures for likely adverse impacts due to the proposed project.

TABLE 1.4: ENVIRONMENT ATTRIBUTES

Sl.No.	Attributes	Parameters	Source and Frequency
1	Ambient Air Quality	PM_{10}, PM $_{2.5}$, SO_2, NO_2	Continuous 24-hourly samples twice a week for three months at 8 locations (2 Core & 6 Buffer)
2	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	Near project site continuous for three months with hourly recording and from secondary sources of IMD station
3	Water quality	Physical, Chemical and Bacteriological parameters	Grab samples were collected at 6 locations – 2 Surface water and 4 Ground water samples; once during study period.
4	Ecology	Existing terrestrial and aquatic flora and fauna within 10 km radius circle.	Limited primary survey and secondary data was collected from the Forest department.
5	Noise levels	Noise levels in dB(A)	8 locations – data monitored once for 24 hours during EIA study
6	Soil Characteristics	Physical and Chemical Parameters	Once at 6 locations during study period
7	Land use	Existing land use for different categories	Based on Survey of India topographical sheet and satellite imagery and primary survey.
8	Socio-Economic Aspects	Socio-economic and demographic characteristics, worker characteristics	Based on primary survey and secondary sources data like census of India 2011.
9	Hydrology	Drainage pattern of the area, nature of streams, aquifer characteristics, recharge and discharge areas	Based on data collected from secondary sources as well as hydro-geology study report prepared.
10	Risk assessment and Disaster Management Plan	Identify areas where disaster can occur by fires and explosions and release of toxic substances	Based on the findings of Risk analysis done for the risk associated with mining.

Source: Field Monitoring Data

1.8.1 Regulatory Compliance & Applicable Laws/Regulations for all Proposed Quarries

- Application for Quarrying Lease as per Tamil Nadu Minor Mineral Concession Rules,1959
- Obtained Precise Area Communication Letter as per Tamil Nadu Minor Mineral Concession Rules, 1959 for Preparation of Mining Plan and obtaining Environmental Clearance
- The Mining Plan has been approved under Rule 41 & 42 as amended of Tamil Nadu Minor Mineral Concession Rules, 1959.
- Letter No SEIAA-TN/F.No.9534/ SEAC/ToR-1347/2022 Dated: 10.02.2023-P1
- Letter No SEIAA-TN/F.No.9668/SEAC/ToR-1351/2022 Dated: 16.02.2023-P2

2. PROJECT DESCRIPTION

2.0 GENERAL

The Proposed Rough Stone Quarry requires Environmental Clearance. There are 2 proposed, 2 existing quarries forming a cluster; calculated as per MoEF & CC Notification S.O. 2269(E) Dated 1st July 2016 and the total extent of cluster is **17.64.55ha.**

As the extent of cluster are more than 5 ha, the proposal falls under B1 Category as per the Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018, and requirement for EIA, EMP and Public Consultation for obtaining Environmental Clearance.

2.1 DESCRIPTION OF THE PROJECT

The proposed projects are site specific and there is no additional area required for this project. There is no effluent generation/discharge from the proposed quarry.

Rough Stone is proposed to be excavated by opencast mechanized method involving splitting of rock mass of considerable volume from the parent rock mass by jackhammer drilling and blasting, hydraulic excavators are used for loading the Rough Stone from pithead to the needy crushers and rock breakers to avoid secondary blasting.

2.2 LOCATION OF THE PROJECT

- The Proposed project fall in Enthoor Village, Marakkanam Taluk and Viluppuram District.
- The project is located about 46 km Southwest of Viluppuram town and 16 km Northeast of Marakkanam town and 1.20 km Northeast side of Enthoor Village.

The project does not fall within 10 km radius of any Eco – sensitive zone, National Park, Tiger Reserve, Elephant Corridor and Biosphere Reserves.

TABLE 2.1: SITE CONNECTIVITY

Nearest Roadway	National Highway (NH-32) Chenna- Tindivanam– 10km - Northwestern State Highway (SH-134) Tindivanam – Marakkanam – 2km - South
Nearest Village	Enthoor – 1.20 Km – NE
Nearest Town	Marakkanam – 16km – NE
Nearest Railway Station	Panchalam Railway Station – 12.0km – NW
Nearest Airport	Chennai Airport – 93km – NE
Seaport	Chennai seaport- 110km - NE

Source: Survey of India Toposheet

TABLE 2.2: BOUNDARY CO-ORDINATES OF PROPOSED PROJECT

PROJECT – P1		
Corner Nos.	**Latitude**	**Longitude**
1	12°13'24.2289" N	79°47'13.2559" E
2	12°13'26.3180" N	79°47'14.1529" E
3	12°13'25.7113" N	79°47'15.6309" E
4	12°13'27.6179" N	79°47'16.8375" E
5	12°13'28.2189" N	79°47'17.4849" E
6	12°13'28.1795" N	79°47'17.5740" E
7	12°13'29.3407" N	79°47'18.2664" E
8	12°13'28.9476" N	79°47'19.5185" E
9	12°13'27.3192" N	79°47'18.9942" E
10	12°13'26.9612" N	79°47'19.7538" E

11	12°13'26.3078" N	79°47'19.5018" E
12	12°13'25.8600" N	79°47'19.9500" E
13	12°13'24.3603" N	79°47'19.2664" E
14	12°13'23.7905" N	79°47'17.5290" E
15	12°13'21.2205" N	79°47'16.1275" E
16	12°13'20.3475" N	79°47'17.0644" E
17	12°13'20.4301" N	79°47'18.1266" E
18	12°13'18.9763" N	79°47'17.2005" E
19	12°13'17.9159" N	79°47'17.0136" E
20	12°13'18.1638" N	79°47'15.3593" E
21	12°13'18.5095" N	79°47'15.4076" E
22	12°13'19.0058" N	79°47'14.2612" E
23	12°13'20.8107" N	79°47'14.3104" E
24	12°13'21.2447" N	79°47'14.4562" E
25	12°13'22.8260" N	79°47'15.0778" E
26	12°13'23.2820" N	79°47'15.0290" E
27	12°13'23.4635" N	79°47'15.7385" E
PROJECT – P2		
Corner Nos.	**Latitude**	**Longitude**
1	12°13'28.91" N	79°47'19.30" E
2	12°13'31.42" N	79°47'20.14" E
3	12°13'35.00" N	79°47'20.63" E
4	12°13'34.38" N	79°47'22.74" E
5	12°13'39.99" N	79°47'24.27" E
6	12°13'38.53" N	79°47'26.07" E
7	12°13'37.88" N	79°47'25.88" E
8	12°13'37.68" N	79°47'26.70" E
9	12°13'36.79" N	79°47'28.92" E
10	12°13'35.50" N	79°47'27.91" E
11	12°13'35.04" N	79°47'29.63" E
12	12°13'36.18" N	79°47'30.46" E
13	12°13'28.59" N	79°47'28.43" E
14	12°13'27.70" N	79°47'28.11" E
15	12°13'24.48" N	79°47'26.75" E
16	12°13'25.10" N	79°47'25.17" E
17	12°13'25.72" N	79°47'25.54" E
18	12°13'27.16" N	79°47'24.30" E
19	12°13'28.43" N	79°47'22.23" E

Source: Approved Mining Plan

FIGURE 2.1: GOOGLE IMAGE OF THE PROJECT AREA P1

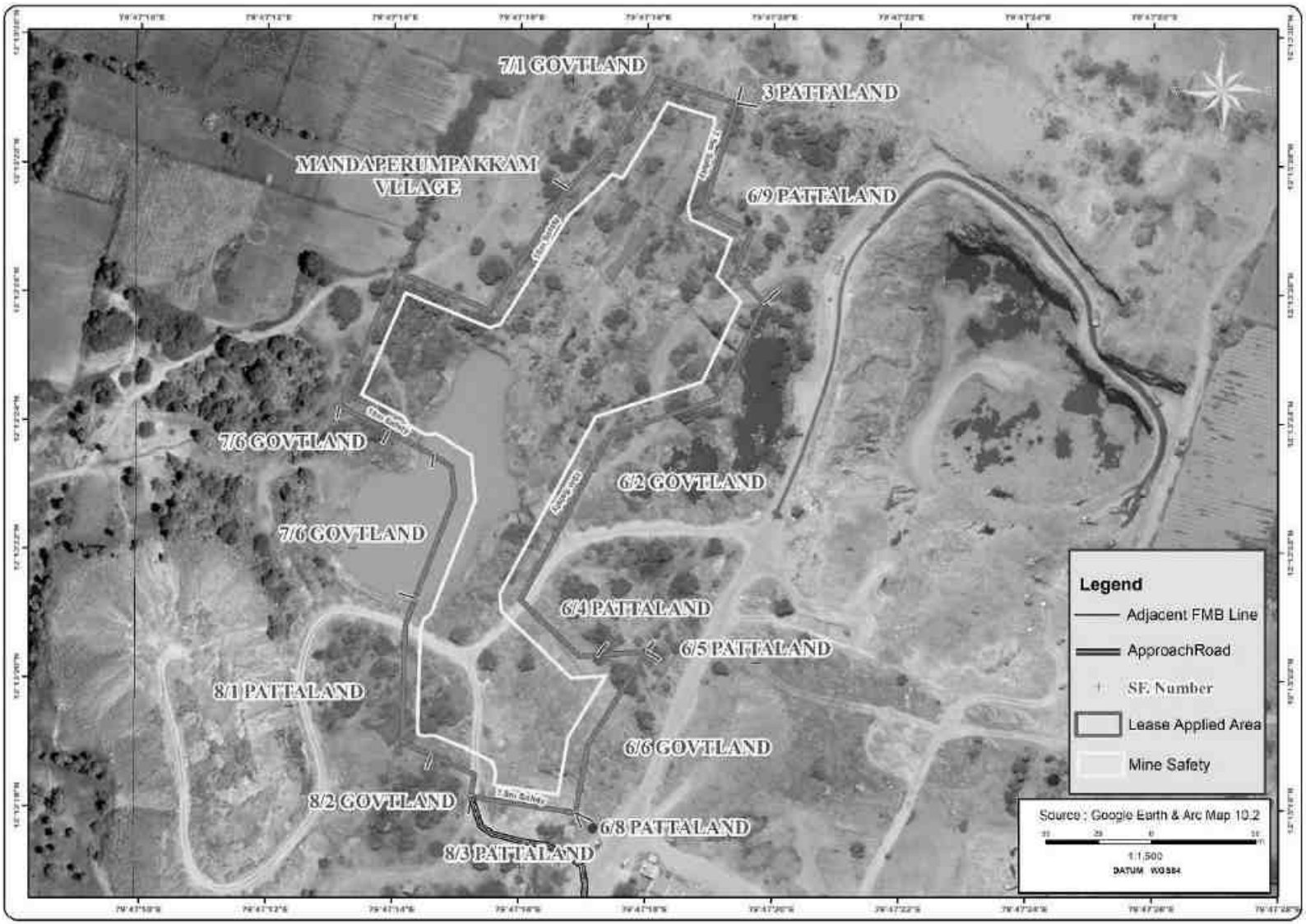
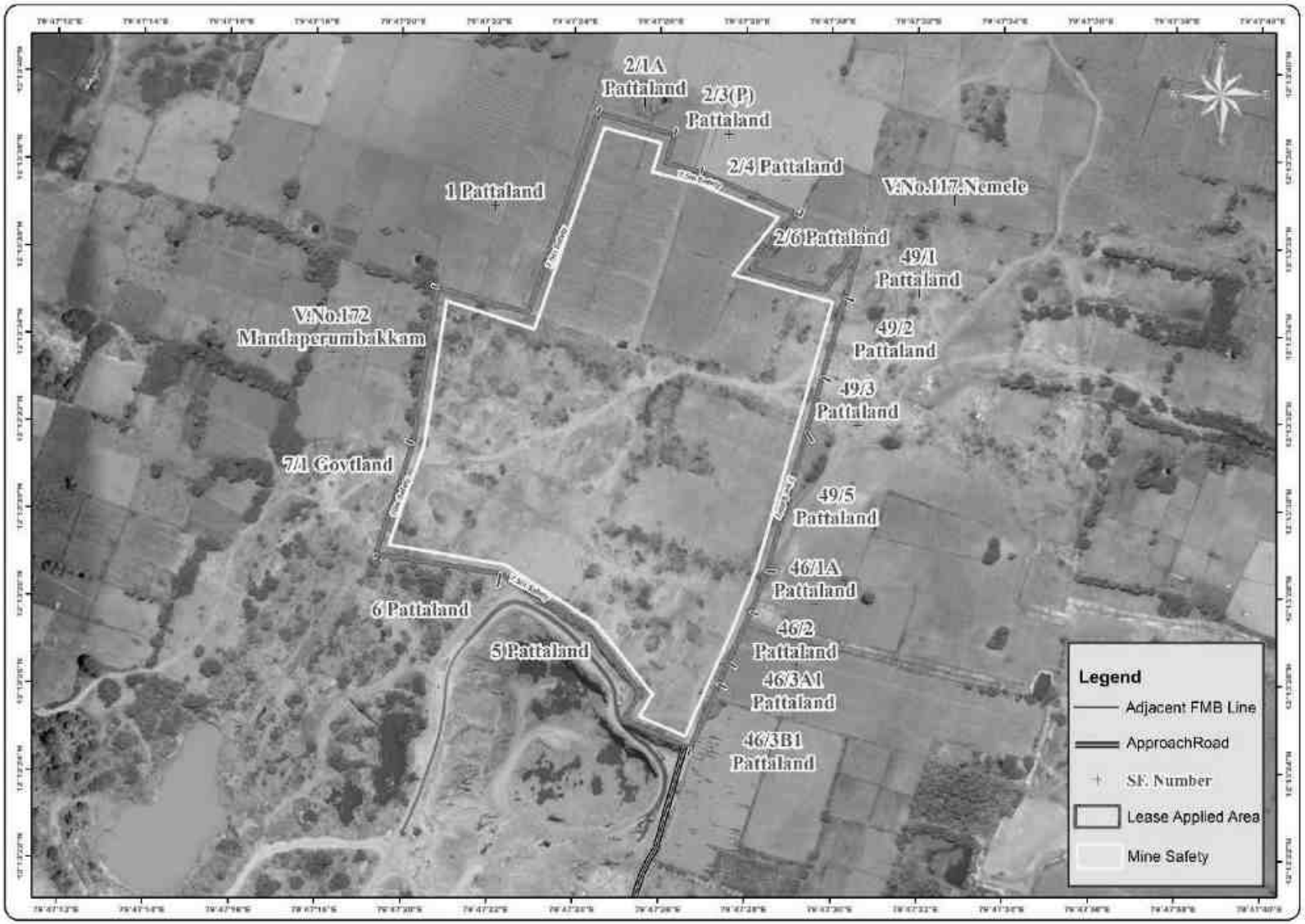
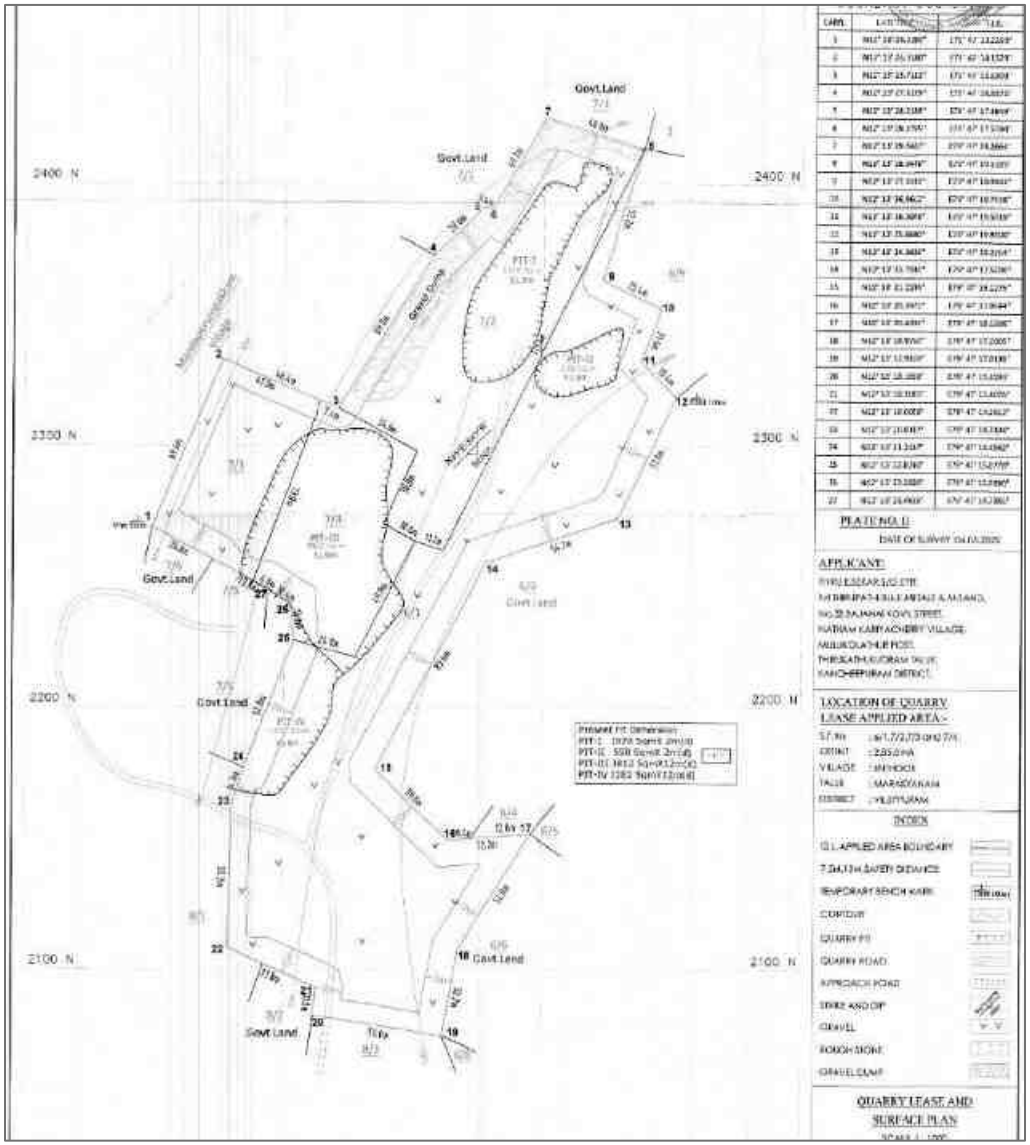


FIGURE 2.1A: GOOGLE IMAGE OF THE PROJECT AREA P2



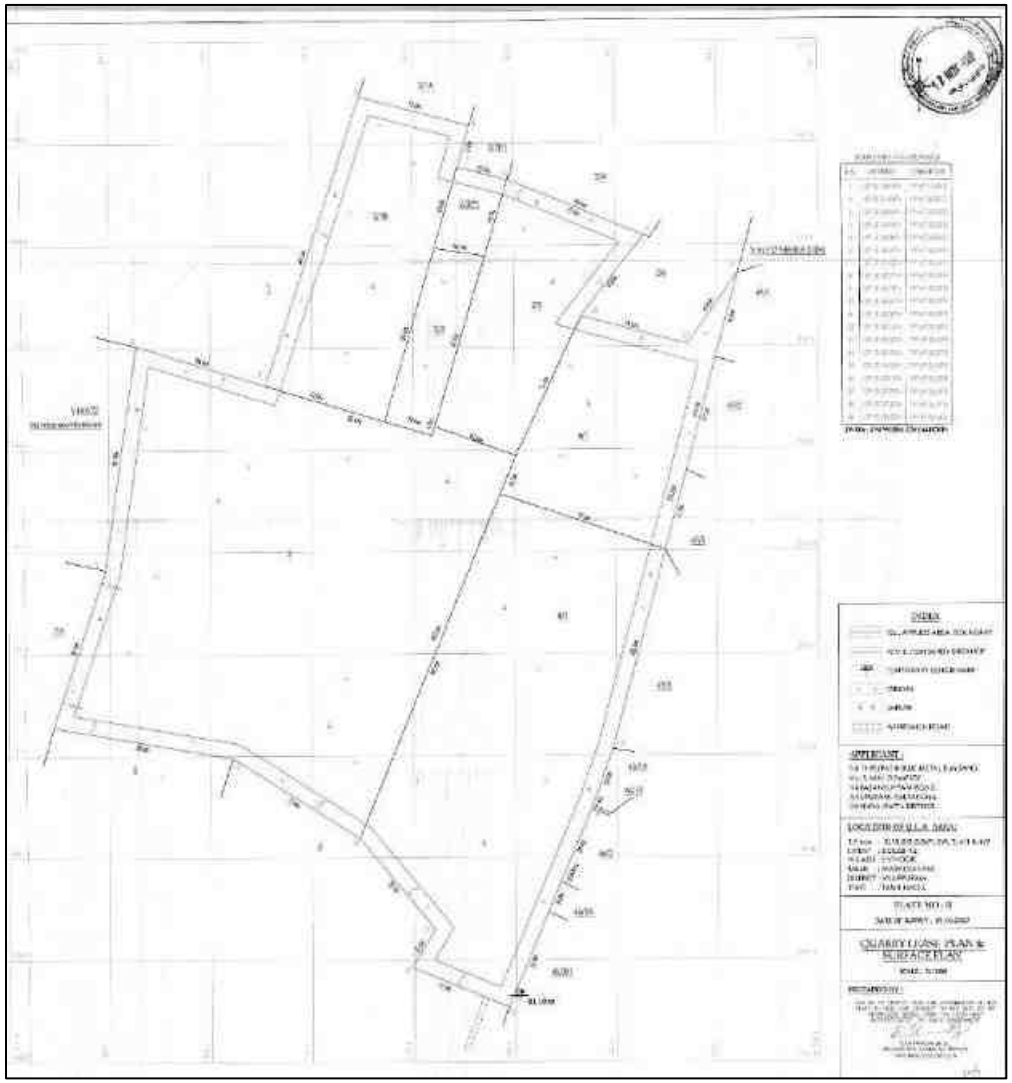
Source: Google Earth Imagery

FIGURE 2.2: QUARRY LEASE PLAN / SURFACE PLAN P1



Source: Approved Mining Plan

FIGURE 2.2A: QUARRY LEASE PLAN / SURFACE PLAN P2



Source: Approved Mining Plan

FIGURE 2.3: VILLAGE MAP SUPERIMPOSED ON GOOGLE EARTH IMAGE

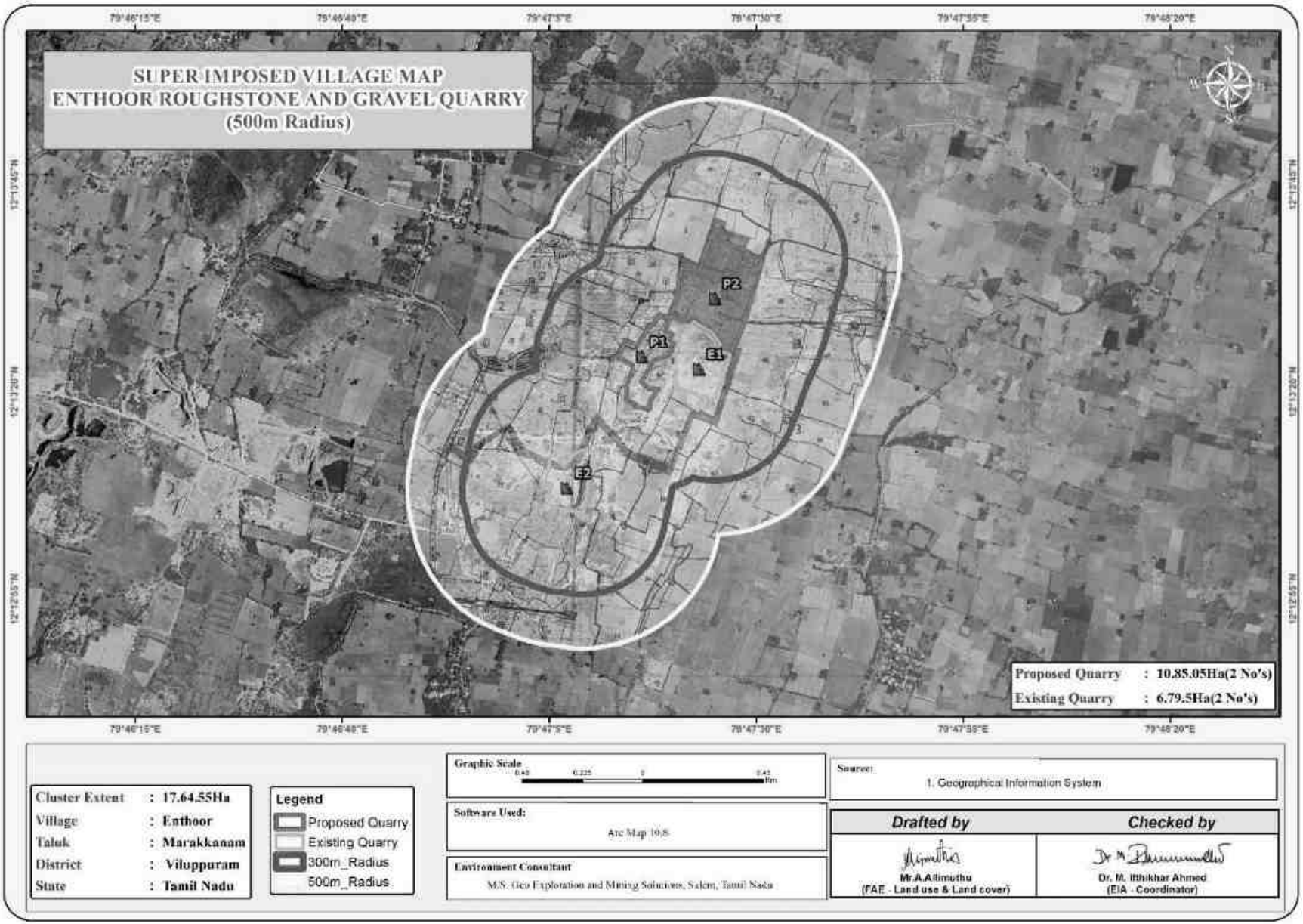


FIGURE 2.4: IMAGE SHOWING SURFACE FEATURES AROUND 10 KM RADIUS

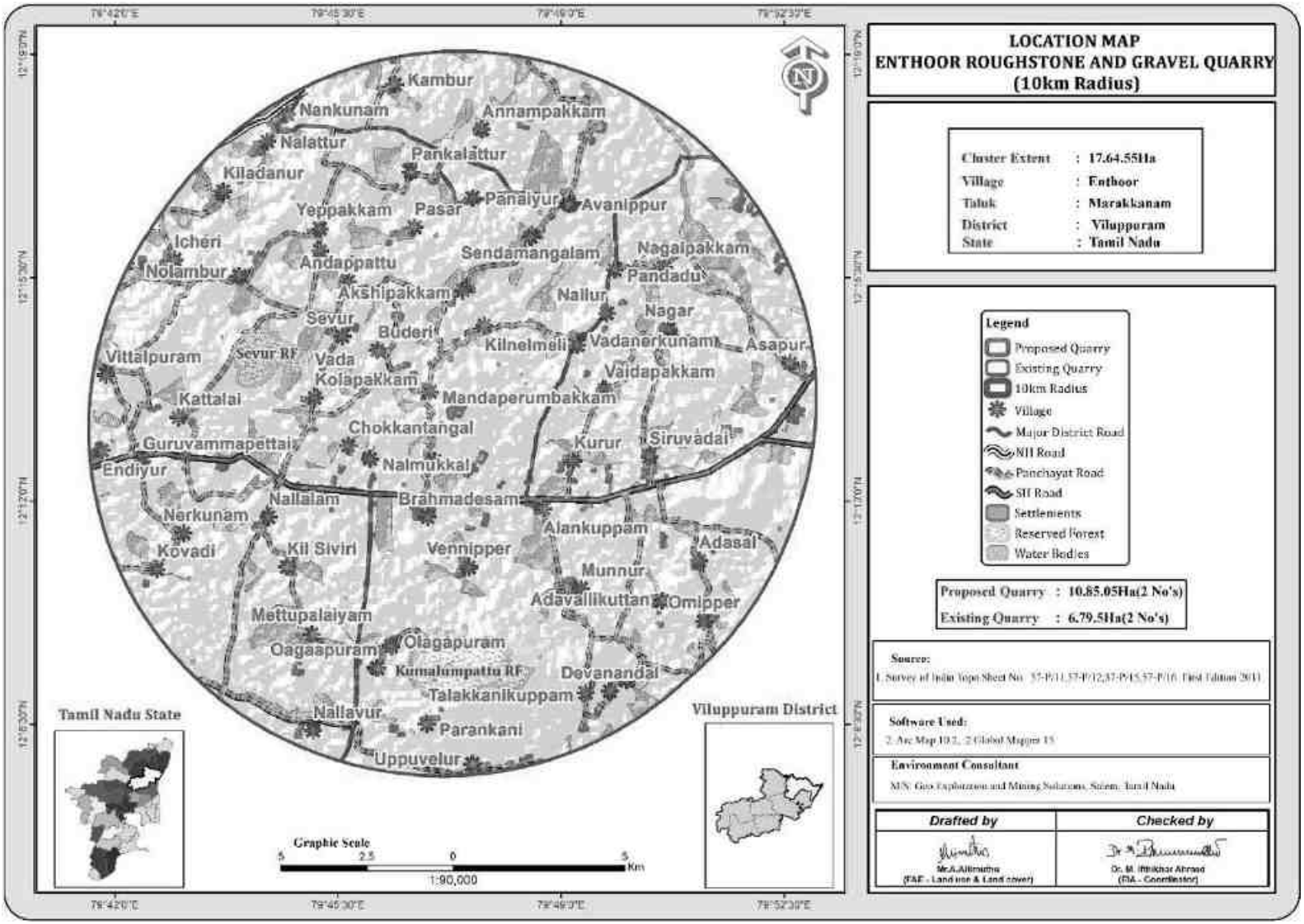


FIGURE 2.5: IMAGE SHOWING SURFACE FEATURES AROUND 5KM RADIUS

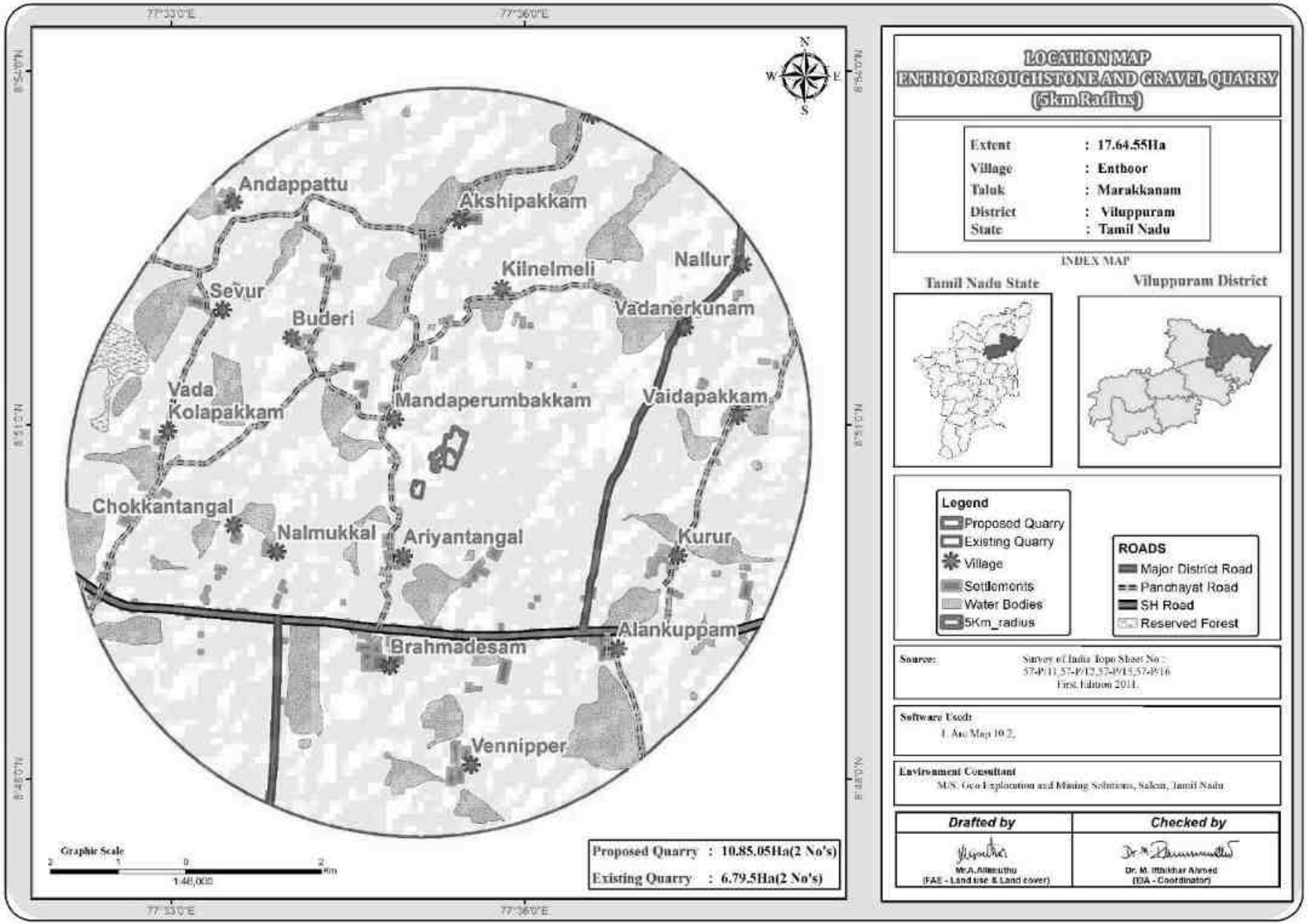
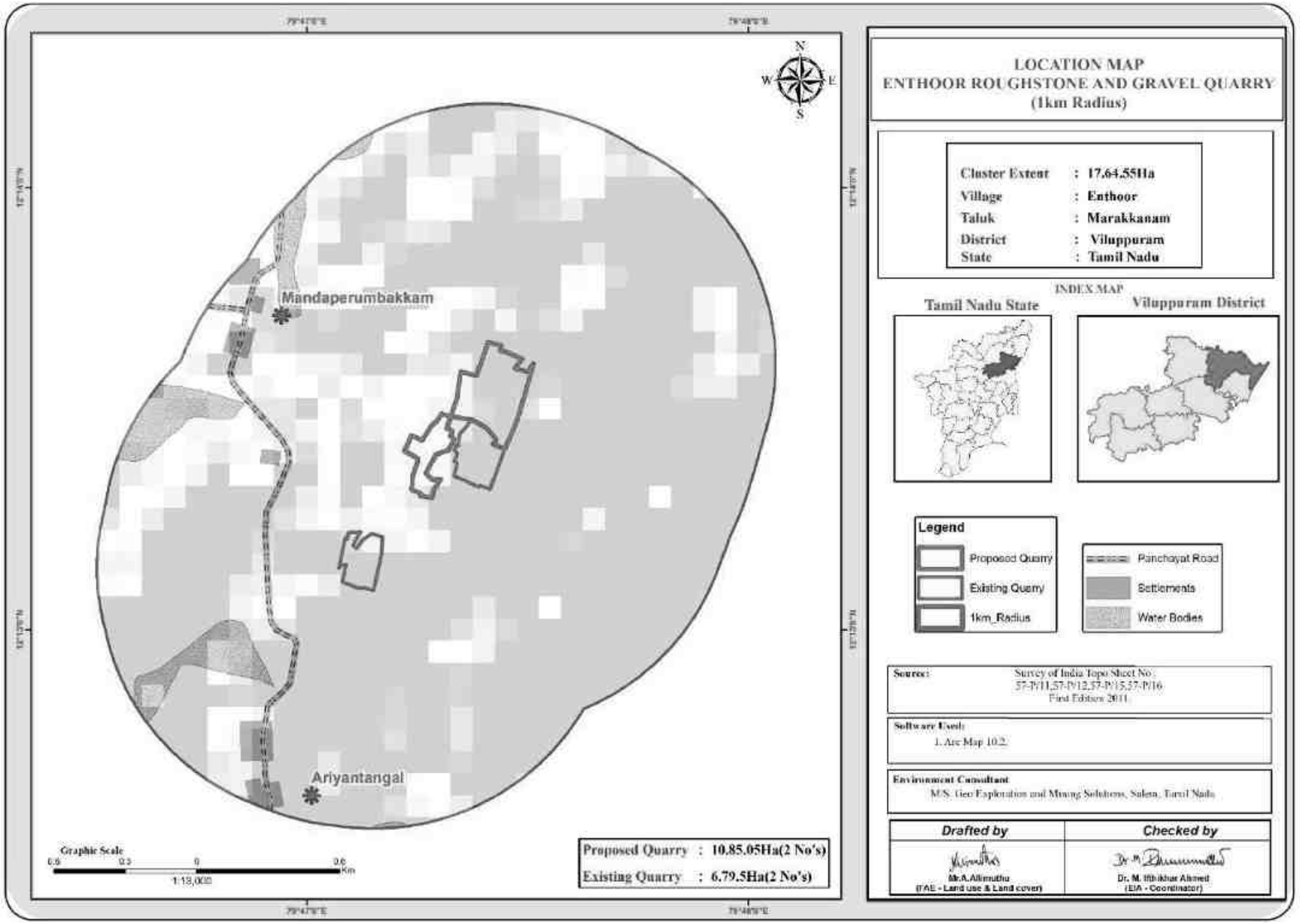


FIGURE 2.6: IMAGE SHOWING SURFACE FEATURES AROUND 1 KM RADIUS



2.2.1 Project Area

- The Proposed Projects are site specific.
- There is no beneficiation or processing proposed inside the project area.
- There is no forest land involved in the proposed project and is devoid of major vegetation and trees.

TABLE 2.3: LAND USE PATTERN OF THE PROPOSED PROJECT

PROJECT – P1		
Description	**Present area in (ha)**	**Area at the end of life of quarry (Ha)**
Area under quarry	0.76.3	2.24.0
Infrastructure	Nil	0.01.0
Road	0.01.0	0.03.0
Green Belt	Nil	0.36.1
Unutilized area	2.07.7	0.20.9
Grand Total	**2.85.0**	**2.85.0**

PROJECT – P2			
Description	**Present area in (ha)**	**Area at the of life of quarry (Ha)**	**Area at the end of life of quarry (Ha)**
Area under quarry	Nil	6.98.70	6.98.70
Infrastructure	Nil	0.01.00	0.01.00
Road	Nil	0.02.0	0.02.00
Green Belt	Nil	0.15.00	0.40.00
Unutilized area	8.00.05	0.83.35	0.58.35
Grand Total	**8.00.05**	**8.00.05**	**8.00.05**

Source: Approved Mining Plans

2.2.2 Size or Magnitude of Operation

TABLE 2.4: OPERATIONAL DETAILS FOR PROPOSED PROJECT

PROJECT – P1		
PARTICULARS	**DETAILS**	
	Rough Stone in m^3 (5Year Plan period)	**Gravel in m^3**
Geological Resources	10,01,221	54,758
Mineable Reserves	2,61,972	27,878
Yearwise production after bench reduction	2,59,242	27,878
Mining Plan Period	5 Years	
Number of Working Days	300 Days	
Production per day	**172 m^3**	**31**
No of Lorry loads (12m^3 per load)	**14**	**3**
Total Depth of Mining	37m bgl (2 m topsoil +35m Rough Stone)	

PROJECT – P2		
PARTICULARS	**DETAILS**	
	Rough Stone in m^3 (5Year Plan period)	**Gravel in m^3**
Geological Resources	42,37,138	1,59,892
Mineable Reserves	24,07,748	1,40,744
Yearwise production as per ToR	11,55,048	1,40,744
Mining Plan Period	5 Years	
Number of Working Days	300 Days	

Production per day	**770**	**156**
No of Lorry loads (6m^3 per load)	**64**	**13**
Proposed Depth as per Mining plan	55m bgl (2m Gravel + 53m Rough Stone)	

Source: Approved mining plan

2.3 GEOLOGY

2.3.1 Regional Geology

Villupuram District is underlain by crystalline metamorphic complex in the western parts of district and sedimentary tract in eastern side. A crystalline rock (63%) and covered by sediments (37%). On regional scale the Charnockite body N45° E–S45° W with dipping towards SE50°.

Regional stratigraphic sequence:

AGE FORMATION

Recent - Quaternary Formation (Gravel)

---------Unconformity----------

Archaean - Charnockite

Peninsular Gneiss complex

i. Charnockite Group represented by Charnockite, Pyroxene Granulite and Magnetite Quartzite
ii Peninsular Gneissic Complex (II) comprising hornblende-biotite gneiss
iii Peninsular Gneissic Complex (II) comprising hornblende-biotite gneiss
iv Younger intrusive comprising, Nepheline-Syenite, Pink Granite, Pegmatite and Quartz veins and
v Younger intrusive comprising, Nepheline-Syenite, Pink Granite, Pegmatite and Quartz veins and
vi Quaternary sediments of Kankar and soil

Stratigraphy of the area –

Age	Group	Lithology
Holocene		Block cotton soil/clay±gypsum
Cenozoic		Kankar/calc-tufa
Neoproterozoic	Acid intrusives	Quartz veins Pegmatite Pink Granite
	Sivamalai syenite Complex	Nepheline-syenite
	Chalk Hills (Basic Intrusives)	Pyroxenite/Dunite
Archaean – Palaeoproterozoic	Peninsular Gneissic Complex (II) PGC (II)	Pink Granite Gneiss Hornblende Biotite gneiss
Archaean	Charnockite Group	Charnockite (Unclassified) Pyroxene Granulite Banded Magnetite Quartzite

Geologically, the district is covered by rocks belonging to Archean age comprising the khondalite group, Charnockite Group, migmatite group, Sathayamangalam group, Bhavani Group and Alkali complex of Proterozoic age and Recent to Late Plestocene rocks of Cainozoic age.

The Charnockite Group of rocks consisting of Charnockite, pyroxene granulites and associated magnetite quartzite, the Knodalite Group comprising gametiferous – sillimanite gneiss, calc-granulite, crystalline limestone, sillimanite quartzites and associated migmatitic gneisses. The rocks are restricted to the central and southern portions of the district.

Source: District Survey Report for Minor Minerals Viluppuram District – May 2019.
https://viluppuram.nic.in/document/district-survey-report-rough-stone/

2.3.2 Local Geology: -

The study area follows the regional trend and mainly comprises of Hard Rock Formation as a homogeneous formation / Batholith formation of Charnockite. The project areas are plain terrain, The project areas are covered with Gravel formation of 2m thickness; Massive Charnockite formation is found after 2m Gravel formation which is clearly inferred from the existing quarry pit.

2.3.3 Hydrogeology

Villupuram district is underlain by crystalline metamorphic complex in the western part of the district and sedimentary tract in eastern side (Plate-II). The thickness of sediments exceeds 600m near southern part of the district. Groundwater occurs under phreatic and semi–confined conditions in consolidated formations, which comprises weathered and fractured granites, gneisses and charnockites whereas in unconsolidated sedimentary rocks the groundwater occurs in phreatic, semi-confined conditions in Vanur sandstone, Kadapperi kuppam formation and Turuvai limestone. The district is having rocky outcrops in major part of Kallakurichi, Sankarapuram and Tirukoilur taluks. The weathering is highly erratic and the depth of abstraction structures is controlled by the intensity of weathering and fracturing. The depth of wells varies from 6.64 to 17 m bgl and water levels in observation wells tapping shallow aquifers varied from 0.74 to 9.7 m bgl during pre monsoon (May 2006) and it varies from 0.7 to 4.45 m bgl during post monsoon (January 2007). During pre monsoon, the depth to water levels in the range of >2 to
5 m bgl in major part of the district, in the range of >5 -10 m bgl in western and southeastern parts of the district and range of 0-2 m bgl were recorded in two isolated pockets. During post monsoon the depth to water levels range of >2 to 5 bgl exists in major part of the district, range of 0 - 2 m bgl prevails in central and northeastern parts of the district and range of >5 - 10 m bgl were recorded in two isolated pockets in the southwestern and north western parts of the district The depth to piezometric surface ranged from 2.8 to 11.25 m bgl during Pre monsoon and 0.5 to 6.35 m bgl during post monsoon. The ground water is being developed my means of dug wells, bore wells and tube wells. The diameter of the well is in the range of 7 to 10 m and depth of dug wells range from 15 to 18 m bgl depending on the weathered thickness and joints. The dug wells yield up to 1 lps in summer months and few wells remains dry. The yield is adequate for irrigation for one or two crops in monsoon period. The yield of bore wells in favorable locations vary from <1 to 6 lps. The valley fills, intersection of lineaments, particularly, in the western part along the foot hills of Kalrayan hills are reported to have potential pockets suitable for dug wells and bore wells. The area of contact between crystalline and sedimentary formations has variable yield prospects. The cretaceous formations are very compact and yield prospects are low. The dug wells of 6 m diameter and 10 m bgl depth in sandy tracts give about 3.5 lps. The yield of tube wells in the sedimentary formation ranges from 2.4 to 37 lp.

2.2.2.3 Aquifer Systems:

Occurrence and storage of groundwater depend upon three factors viz., Geology, Topography and rainfall in the form of precipitation. Apart from Geology, wide variation in topographic profile and intensity of rainfall constitutes the prime factors of groundwater recharge. Aquifers are part of the more complex hydro geological system and the behaviour of the entire system cannot be interpreted easily. In hard rock terrain the occurrence of Ground Water is limited to top weathered, fissured and fractured zone which extends to maximum 30 m on an average it is about 10-15 m in Viluppuram District.

In Sedimentary formations, the presence of primary inter granular porosity enhances the transmitting capacity of groundwater where the yield will be appreciable. The sedimentary area which occupies the eastern part of the district along the coastal tract is more favourable for groundwater recharge. Ground Water occurs both in semi confined and confined conditions. A brief description of occurrence of groundwater in each formation is furnished below.

2.2.2.3 Alluvial Formations

In the river alluvium groundwater occurs under water table condition. The maximum thickness is 37 m and the average thickness of the aquifer is approximately 12 m. These formations are porous and permeable which have good water bearing zones.

Tertiary Cuddalore sandstone

Tertiary formations are represented by Cuddalore Sandstone and characterised as fluvial to brakish marine deposits. Predominantly this formation is divided into Lower and Upper Cuddalore formations. In the Upper Cuddalore formations the groundwater occurs in semi confined conditions, whereas in the Lower Cuddalore the groundwater occurs in confined condition with good groundwater potential.

Cretaceous Formations

Groundwater occurring in the lens shape in the sandy clay lenses and fine sand is underlain by white and black clay beds which constitute phreatic aquifer depth which ranges 10m to 15m below ground level. Phreatic aquifer in Limestone is potential due to the presence of Oolitic Limestone.

Hard Rock Formations

Groundwater occurs under water table conditions but the intensity of weathering, joint, fracture and its development is much less in other type of rocks when compared to gneissic formation. The groundwater potential is low, when compared with the gneissic formations

Granitic Gneiss

Groundwater occurs under water table conditions in weathered, jointed and fractural formations. The pore space developed in the weathered mantle acts as shallow granular aquifers and forms the potential water bearing and yielding zones water table is shallow in canal and tank irrigation regions and it is somewhat deeper in other regions.

Charnockite

Groundwater occurs under water table conditions but the intensity of weathering, joint, fracture and its development is much less when compared to gneissic formations. The groundwater potential is low, when compared with the gneissic formations.

Aquifer Parameters

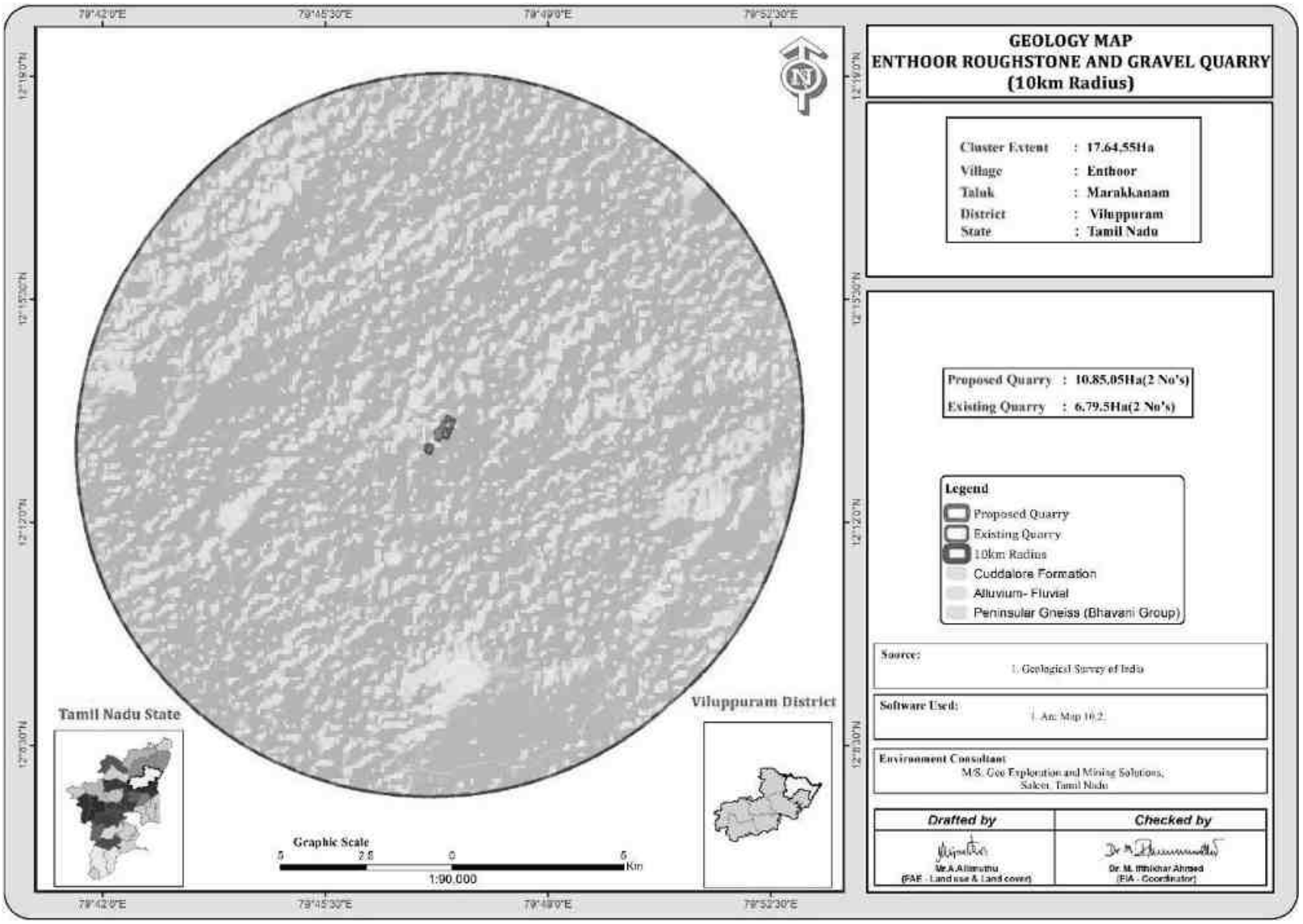
The transmissivity values of fractured aquifers range from < 1 to 141 m2 /day and storativity varies between 2.84x10.5-5 and 8.9x10-3. The transmissivity of sedimentary formation varies from 21 to 748 m^2 /day and storativity is in the order of 2.75x10-3

.

Actual Rainfall in Mm					Normal Rainfall in Mm
2017	2018	2019	2020	2021	
1066.9	727.5	906.3	1137.7	1935.2	985

https://www.twadboard.tn.gov.in/content/villupuram

FIGURE 2.7: REGIONAL GEOLOGY MAP



From the above map it is inferred that the cluster quarries fall in the hard rock terrain (Peninsular Gneiss)

FIGURE 2.8: GEOMORPHOLOGY MAP

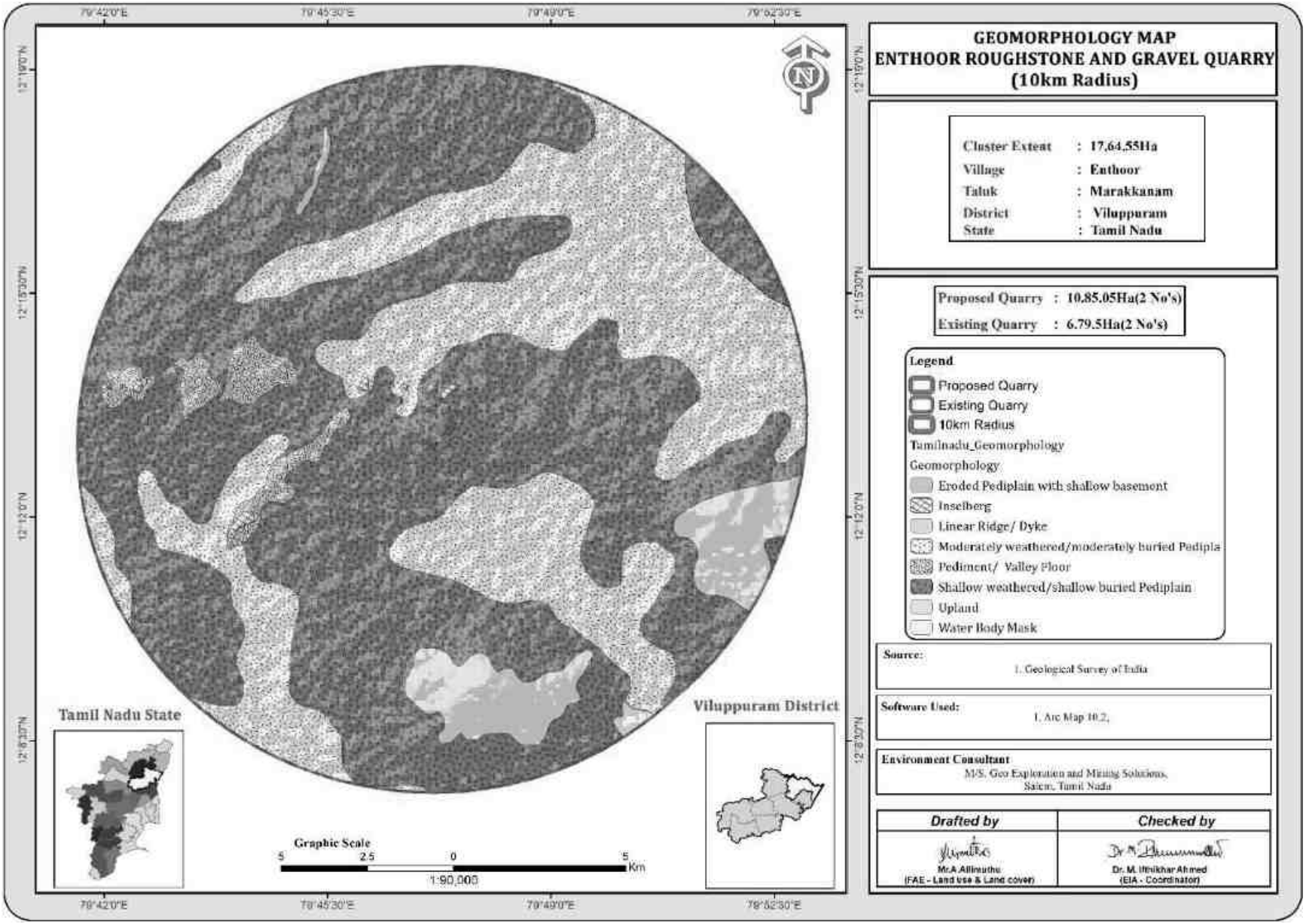


FIGURE 2.9: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS – P1

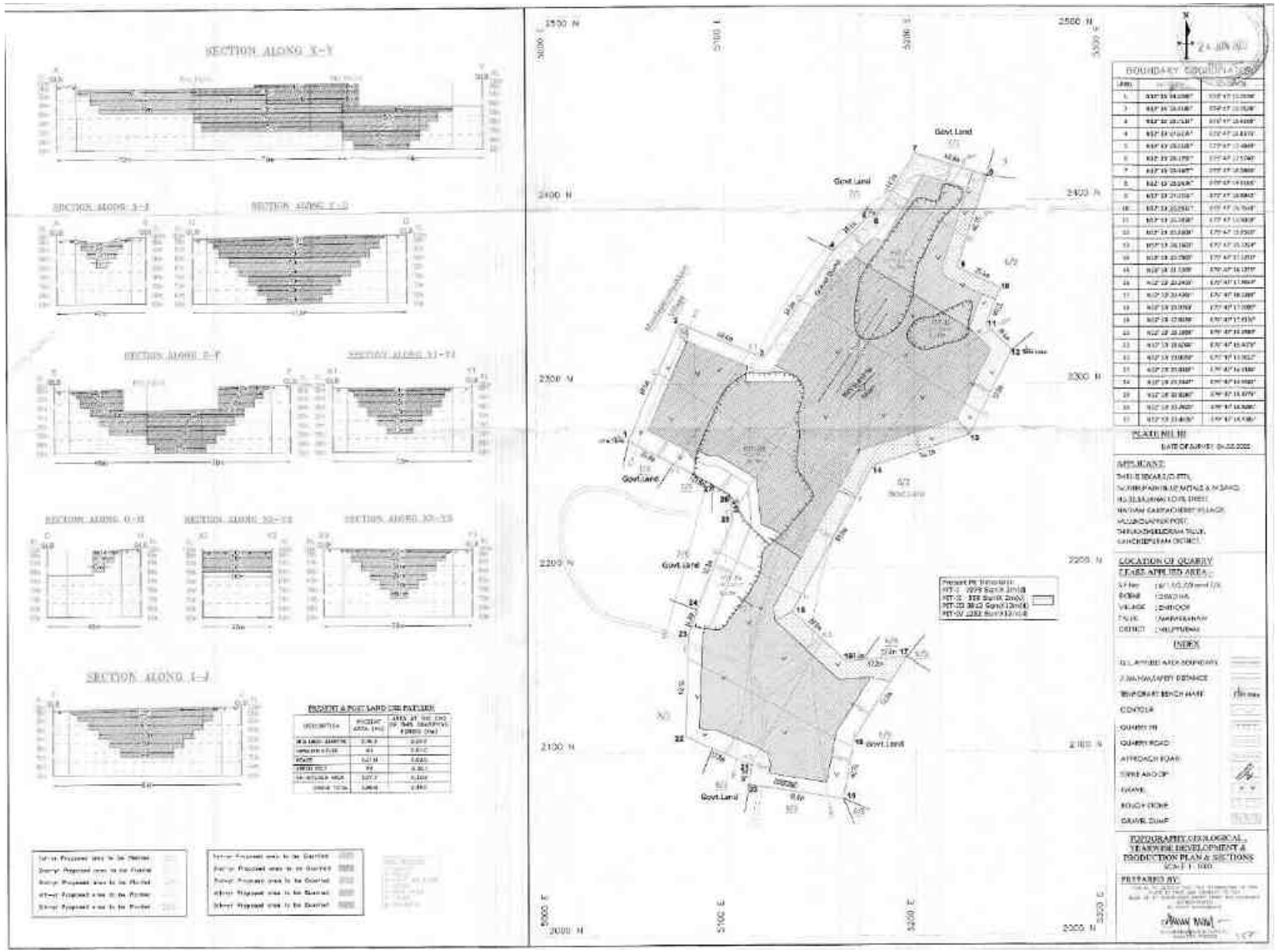
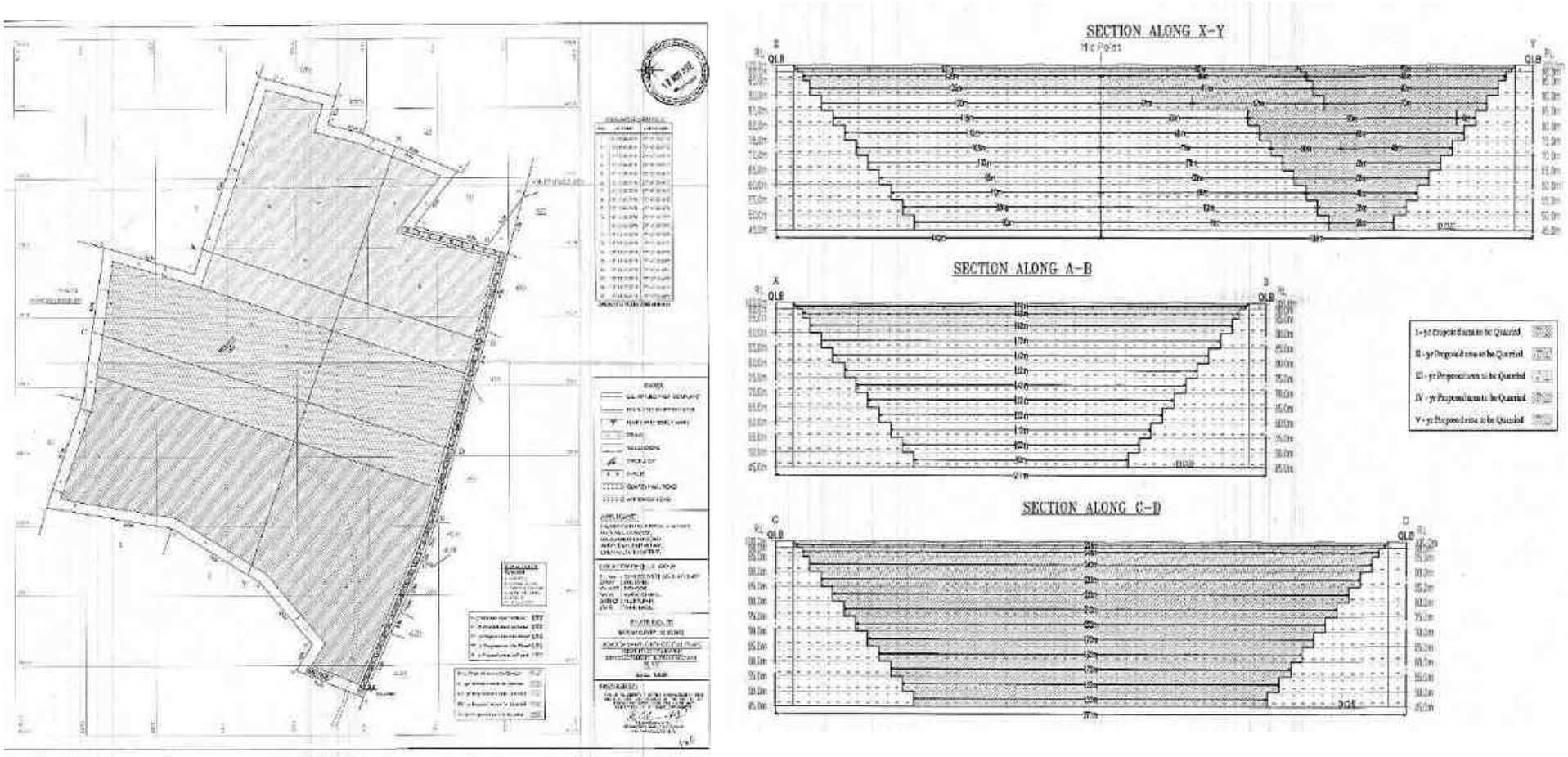


FIGURE 2.9A: TOPOGRAPHY, GEOLOGICAL, YEAR-WISE DEVELOPMENT PRODUCTION PLAN AND SECTIONS – P2



Source: Approved Mining Plan

FIGURE 2.10: CLOSURE PLAN AND SECTIONS – P1

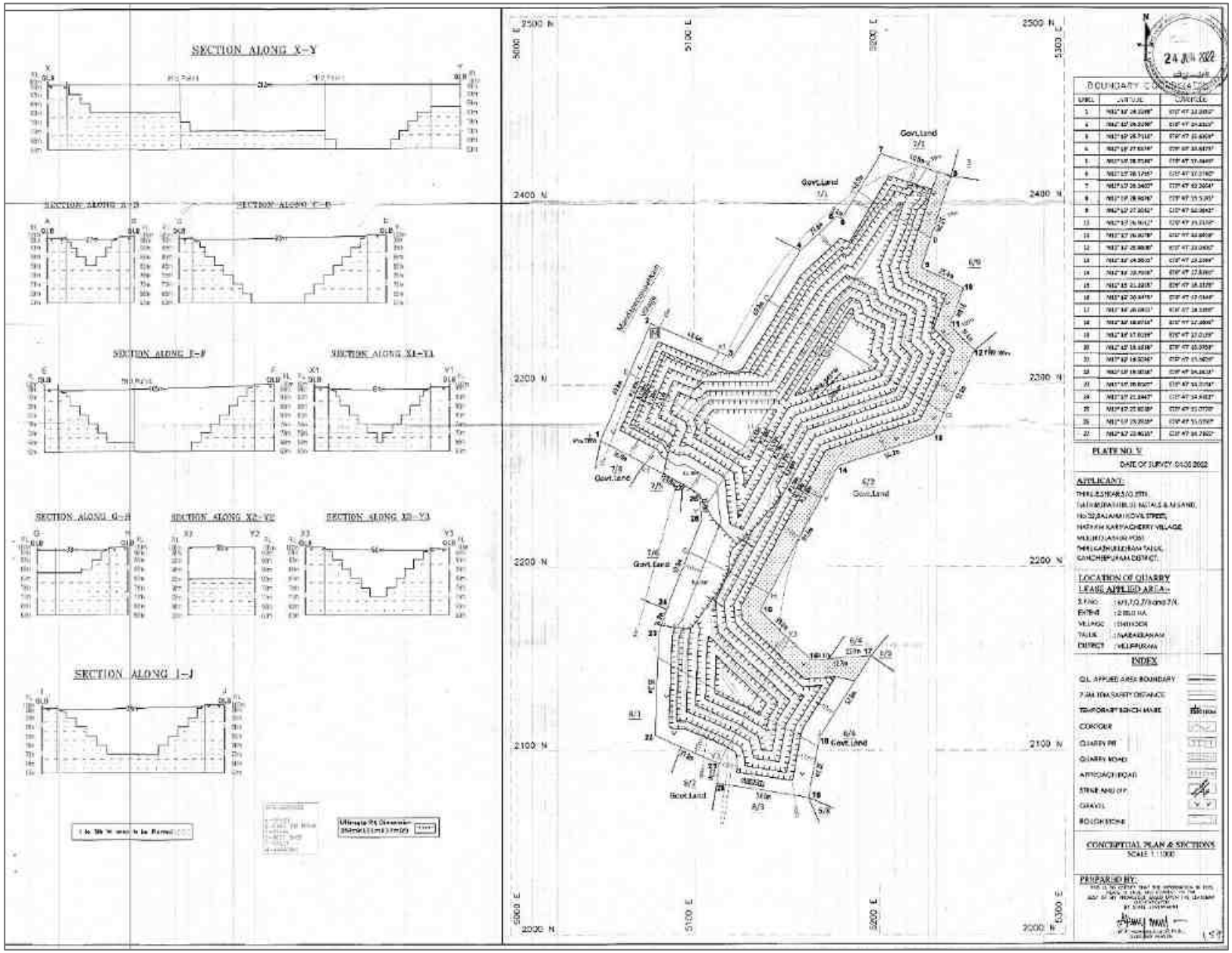
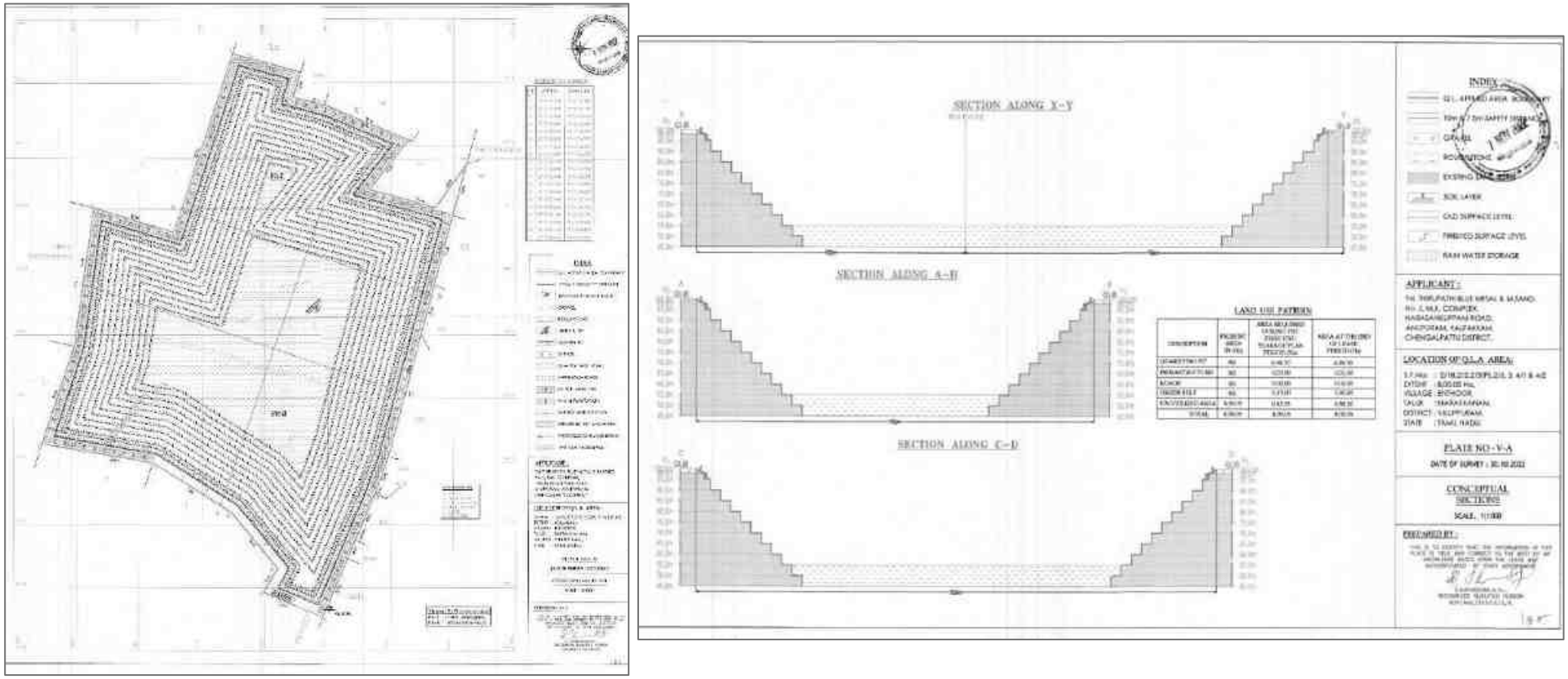


FIGURE 2.10A: CLOSURE PLAN AND SECTIONS – P2



Source: Approved Mining Plan

2.4 RESOURCES AND RESERVES

The Resources and Reserves of Rough Stone were calculated based on Cross-Section Method by plotting sections to cover the maximum lease area for all the proposed projects.

Based on the availability of Geological Resources the Mineable Reserves are calculated by considering excavation system of bench formation and leaving essential safety distance of 7.5 m (Safety Barrier all around the applied area) and safety distance as per precise area communication letter and deducting the locked up reserves during bench formation (Also called as Bench Loss) and the Mineable Reserves is calculated considering there is no waste / overburden / side burden (100% Recovery Anticipated) for all the proposed projects.

TABLE 2.6: AVAILABLE GEOLOGICAL RESOURCES OF PROPOSED PROJECT

PROPOSAL – P1		
Description	Rough Stone	Gravel
Geological Resource in m^3	10,01,221	54,758
Mineable Resource in m^3	2,61,972	27,878
PROPOSAL – P2		
Description	Rough Stone	Gravel
Geological Resource in m^3	42,37,138	1,59,892
Mineable Resource in m^3	24,07,748	1,40,744

Source: Approved Mining Plan

TABLE 2.7: YEAR-WISE PRODUCTION PLAN

P1		
YEAR	**ROUGH STONE (m^3)**	**GRAVEL (m^3)**
I	43,514	9,744
II	65,366	11,996
III	51,677	6,138
IV	48,500	-
V	50,185	-
TOTAL	**2,59,242**	**27,878**
P2		
YEAR	**ROUGH STONE (m^3)**	**GRAVEL (m^3)**
I	2,41,984	46,736
II	2,41,702	43,180
III	2,40,062	50,828
IV	2,41,660	-
V	1,89,640	-
TOTAL	**11,55,408**	**1,40,744**

Source: Approved Mining Plan

Disposal of Waste

There is no waste anticipated in these Rough Stone quarrying operation. The entire quarried out materials will be utilized (100%).

Conceptual Mining Plan/ Final Mine Closure Plan

The ultimate pit size is designed based on certain practical parameters such as economical depth of mining, safety zones, permissible area, etc.

TABLE 2.8: ULTIMATE PIT DIMENSION

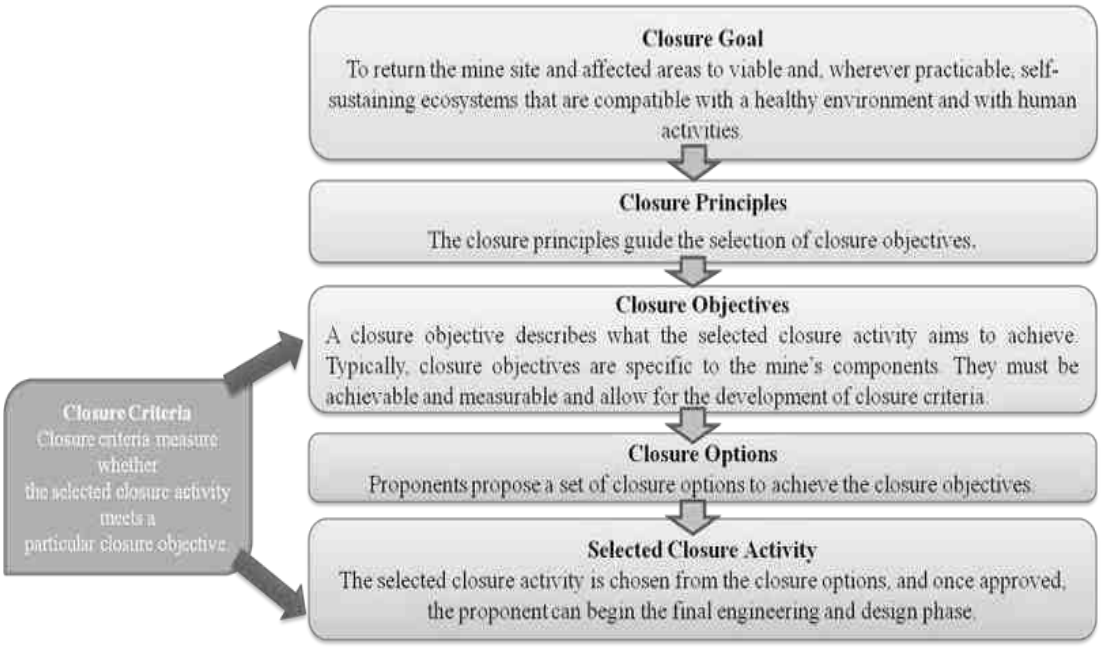
PROPOSAL – P1			
Pit	**Length (Max) (m)**	**Width (Max) (m)**	**Depth (Max) (m)**
1	359	105	37
PROPOSAL – P2			
Pit	**Length (Max) (m)**	**Width (Max) (m)**	**Depth (Max) (m)**
1	132	196	50
2	186	256	55

Source: Approved Mining Plan

- At the end of life of mine, the excavated mine pit / void will act as artificial reservoir for collecting rain water and helps to meet out the demand or crises during drought season.
- After mine closure the greenbelt developed along the safety barrier and top benches and temporary water reservoir will enhance the ecosystem
- Mine Closure is a process of returning a disturbed site to its natural state or which prepares it for other productive uses that prevents or minimizes any adverse effects on the environment or threats to human health and safety.
- The principal closure objectives are for rehabilitated mines to be physically safe to humans and animals, geo-technically stable, geo-chemically non-polluting/ non-contaminating, and capable of sustaining an agreed post-mining land use.

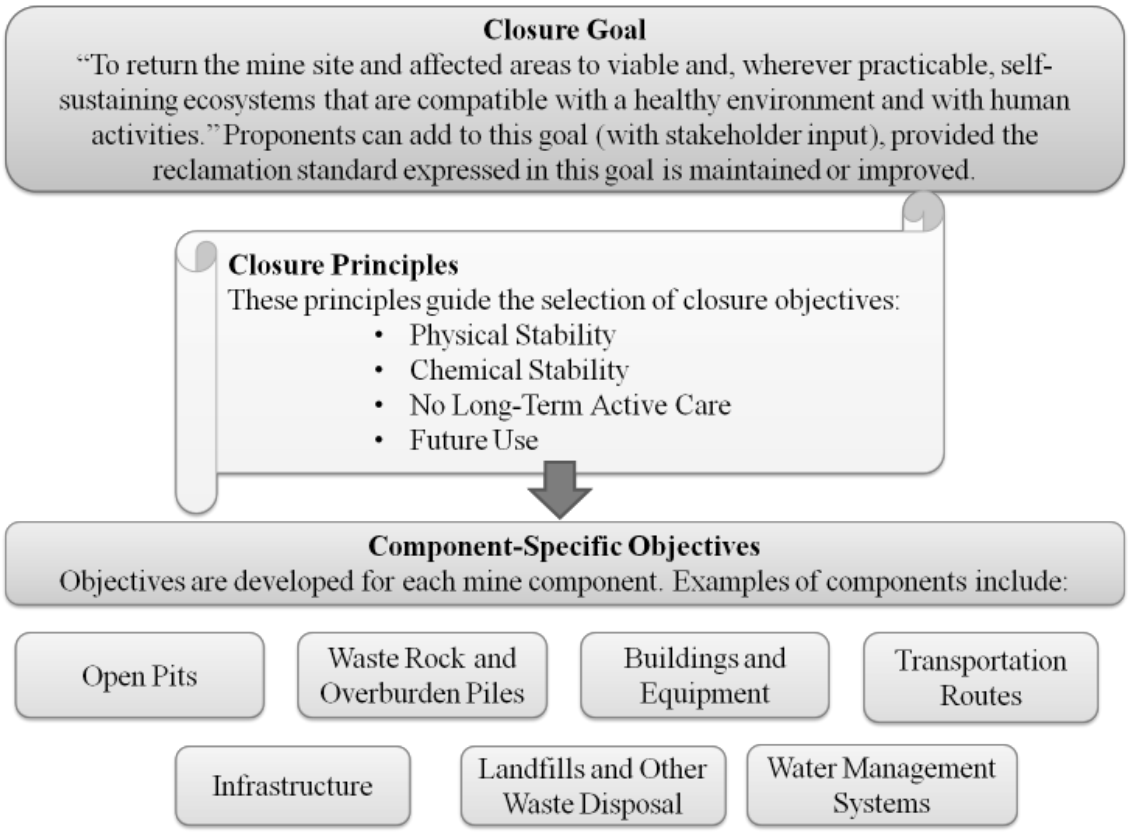
Closure Objectives –

- Access to be limited, for the safety of humans and wildlife.
- The open pit mine workings and pit boundary are physically and geo-technically stable.
- Water quality in flooded pits is safe for humans, aquatic life, and wildlife.
- Discharge of contaminated drainage has been minimized and controlled.
- Original or desired new surface drainage patterns have been established.
- For flooded pits, in-pit aquatic habitat has been established where practical and feasible.
- Emergency access and escape routes from flooded pits for humans and wildlife are in place.
- Dust levels are safe for people, vegetation, aquatic life, and wildlife.



Closure Planning & Options Considerations in Mine Design –

- The closure of mine is well planned at the initial stage of planning & design consideration by the internal and external stake holders
- Construction of 2m height bund all along the mine pit boundary and ensure its stability all time & construction of garland drain along the natural slope to avoid sliding and collection of soil to the pit & surface runoff during rainfall
- After complete exploitation of mineral, the lowest bench foot wall side will be maintained as plain surface without any sump pits to avoid any accidents
- All the sharp edges will be dressed to smoother face before the closure of mine and ensure no loose debris on hanging wall side
- There is a canal on Western side of the cluster project area. The river canal will not be hindered by any of mine closure activities
- The project proponent as a part of social responsibilities assures to supply the stored mine pit water to the nearby villages after effective treatment process as per the standards of TNPCB & TWAD
- Native species will be planted in 3 row patterns on the boundary barriers and 1st bench, a full-time sentry will be appointed at the gate to prevent inherent entry of public & cattle.
- The access road to the quarry will be cut-off immediately after the closure
- The layout design shall be prepared and get approved from Department of Geology and Mining.
- The proponent is instructed to construct as per the layout approved
- Physical and chemical stability of structures left in place at the site, the natural rehabilitation of a biologically diverse, stable environment, the ultimate land use is optimized and is compatible with the surrounding area and the requirements of the local community, and taking the needs of the local community into account and minimizing the socio-economic impact of closure
- There will be a positive change in the environmental and ecology due to the mine closure.



Post-Closure Monitoring –

The purpose of post-closure monitoring with respect to open pit mine workings is to ensure the attainment of closure objectives.

- Monitor physical and geotechnical stability of remnant pit walls.
- Monitor the ground regime in pit walls to confirm achievement of design objectives.
- Monitor water level in pit to confirm closure objectives regarding fish, fish habitat, and wildlife safety are being achieved.
- Sample water quality and quantity at controlled pit discharge points.
- Identify and test unanticipated areas where water management is an issue.
- Inspect integrity of barriers such as berms & fences.
- Monitor wildlife interactions with barriers to determine effectiveness.
- Inspect aquatic habitat in flooded pits where applicable.
- Monitor dust levels.

Post-Closure Monitoring –

The purpose of post-closure monitoring with respect to open pit mine workings is to ensure the attainment of closure objectives

TABLE 2.9: MINE CLOSURE BUDGET

PROPASAL- P1							
Activity	**Year**						
	I	II	III	IV	V	**Cost** (Rs)	**Total Cost** (Rs)
Plantation in Nos inside of the site	700	-	-	-	-	@ 200 Rs/ Saplings	Rs. 1,40,000
Plantation in Nos outside of the site	1000	-	-	-	-	@ 100 Rs/ Saplings	Rs. 1,00,000
Renovation of Wire Fencing (1060 meters)	3,18,000	-	-	-	-	@ Rs.300 per meter	Rs. 3,18,000
Renovation of Garland Drain (890 meters)	2,67,000	-	-	-	-	@ Rs.300 per meter	Rs.2,67,000
Total							**Rs. 8,25,000**
PROPASAL- P2							
Activity	**Year**						
	I	II	III	IV	V	**Cost** (Rs)	**Total Cost** (Rs)
Plantation in Nos inside of the site	900	-	-	-	-	@ 200 Rs/ Saplings	Rs. 1,80,000
Plantation in Nos outside of the site	3900	-	-	-	-	@ 100 Rs/ Saplings	Rs. 3,90,000
Renovation of Wire Fencing (1370 meters)	4,11,000	-	-	-	-	@ Rs.300 per meter	Rs.4,11,000
Renovation of Garland Drain (1220 meters)	3,66,000	-	-	-	-	@ Rs.300 per meter	Rs.3,66,000
Total							**Rs. 13,47,000**

Source: Proposed by FAE's and EC

2.5 METHOD OF MINING

The method of mining is Opencast Mechanized Mining Method is being proposed by formation of 5.0-meter height bench with a bench width not less than the bench height. However, as far as the quarrying of Rough Stone is concerned, observance of the provisions of Regulation 106 (2) (b) as above is seldom possible due to various inherent petro genetic factors coupled with mining difficulties. Hence it is proposed to obtain relaxation to the provisions of

the above regulation from the Director of Mines Safety for which necessary provision is available with the Regulation 106 (2) (b) of MMR-1961, under Mine Act – 1952.

The Rough Stone is a batholith formation and the splitting of rock mass of considerable volume from the parent rock mass will be carried out by deploying jackhammer drilling and Slurry Explosives will be used for blasting. Hydraulic Excavators attached with Rock Breakers unit will be deployed for breaking large boulders to required fragmented sizes to avoid secondary blasting and hydraulic excavators attached with bucket unit will be deployed for loading the Rough Stone into the tippers and then the stone is transported from pithead to the nearby crushers.

2.5.1 Drilling & Blasting Parameters

Drilling & Blasting will be carried out as per parameters given below: -

Spacing	–	1.2m
Burden	–	1.0 m
Depth of hole	–	1.5 m
Charge per hole	–	0.50 – 0.75kg
Powder factor	–	6.0 tonnes/kg
Diameter of hole	–	32 mm

Type of Explosives to be used –

Slurry explosives (An explosive material containing substantial portions of a liquid, oxidizers, and fuel, plus a thickener), NONEL / Electric Detonator &Detonating Fuse.

Storage of Explosives –

No proposal for storage of explosives within the project area, the respective project proponents have made agreement with authorized explosives agencies for carrying out blasting activities and competent person as per DGMS guidelines will be employed for safety and supervision of overall quarrying activities.

The explosives will be sourced from the blasting agency on daily basis and the blasting will be carried out under the supervision of competent qualified Blaster and it will be ensured that there shall be no balance of explosive stock; any balance stock will be taken back by the supplier.

2.5.2 Extent of Mechanization

TABLE 2.10 PROPOSED MACHINERY DEPLOYMENT

S.NO.	TYPE	NOS	SIZE/CAPACITY	MOTIVE POWER
1	Jack hammers	8	1.2m to 2.0m	Compressed air
2	Compressor	2	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker	2	300 HP	Diesel Drive
4	Tippers	4	20 Tonnes	Diesel Drive
S.NO.	**TYPE**	**NOS**	**SIZE/CAPACITY**	**MOTIVE POWER**
1	Jack hammers	6	1.2m to 2.0m	Compressed air
2	Compressor	2	400psi	Diesel Drive
3	Excavator with Bucket / Rock Breaker	2	300 HP	Diesel Drive
4	Wagon Drill	2	60 HP	TAM Rock
5	Tippers	8	35 Tonnes	Diesel Drive

Source: Approved Mining Plan

2.6 GENERAL FEATURES

2.6.1 Existing Infrastructures

Infrastructures like Mine office, Temporary Rest shelters for workers, Latrine and Urinal Facilities will be constructed as per the Mine Rule after the grant of quarry lease in all the proposed quarries.

2.6.2 Drainage Pattern

Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin over time that reveals characteristics of the kind of rocks and geological structures in a landscape. They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land.

Dendritic drainage pattern is one of the most common types that develop in areas where the rock (or unconsolidated material) beneath the stream has no particular fabric or structure and can be easily eroded equally in all directions.

There are no streams, canals or water bodies crossing within the project area. The drainage pattern of the area is dendritic – sub dendritic.

2.6.3 Traffic Density

The traffic survey conducted based on the transportation route of material, the Rough Stone is proposed to be transported mainly through State Highway_Tindivanam to Marakanam Road - 2.5km South side and Major District Road_Avanipur to Tindivanam Road - 3.0km Northwest side.

Traffic density measurements were performed at two locations

1. State Highway_Tindivanam to Marakanam Road - 2.5km South side.
2. Major District Road_Avanipur to Tindivanam Road - 3.0km Northwest side.

Traffic density measurement were made continuously for 24 hours by visual observation and counting of vehicles under three categories, viz., Heavy motor vehicles, light motor vehicles and two/three wheelers. As traffic densities on the roads are high, two skilled persons were deployed simultaneously at each station during each shift- one person on either direction for counting the traffic. At the end of each hour, fresh counting and recording was undertaken.

TABLE.2.11: TRAFFIC SURVEY LOCATIONS

Station Code	Road Name	Distance and Direction	Type of Road
TS1	Tindivanam to Marakanam Road	2.5 km South	State highway
TS2	Avanipur to Tindivanam Road	3.0km Northwest	District Road

Source: On-site monitoring by GEMS FAE & TM

TABLE 2.12: EXISTING TRAFFIC VOLUME

Station code	HMV		LMV		2/3 Wheelers		Total PCU
	No	PCU	No	PCU	No	PCU	
TS1	204	612	172	172	232	116	900
TS2	92	276	42	42	166	83	401

Source: On-site monitoring by GEMS FAE & TM

* PCU conversion factor: HMV (Trucks and Bus) = 3, LMV (Car, Jeep and Auto) = 1 and 2/3 Wheelers = 0.5

TABLE 2.13: ROUGH STONE & GRAVEL HOURLY TRANSPORTATION REQUIREMENT

Transportation of Rough Stone per day		
Capacity of trucks	No. of Trips per day Cumulatively	Volume in PCU
10/20 tonnes	78	234

Source: Data analysed from Approved Mining Plan

FIGURE.2.11: MINERAL TRANSPORTATION ROUTE MAP

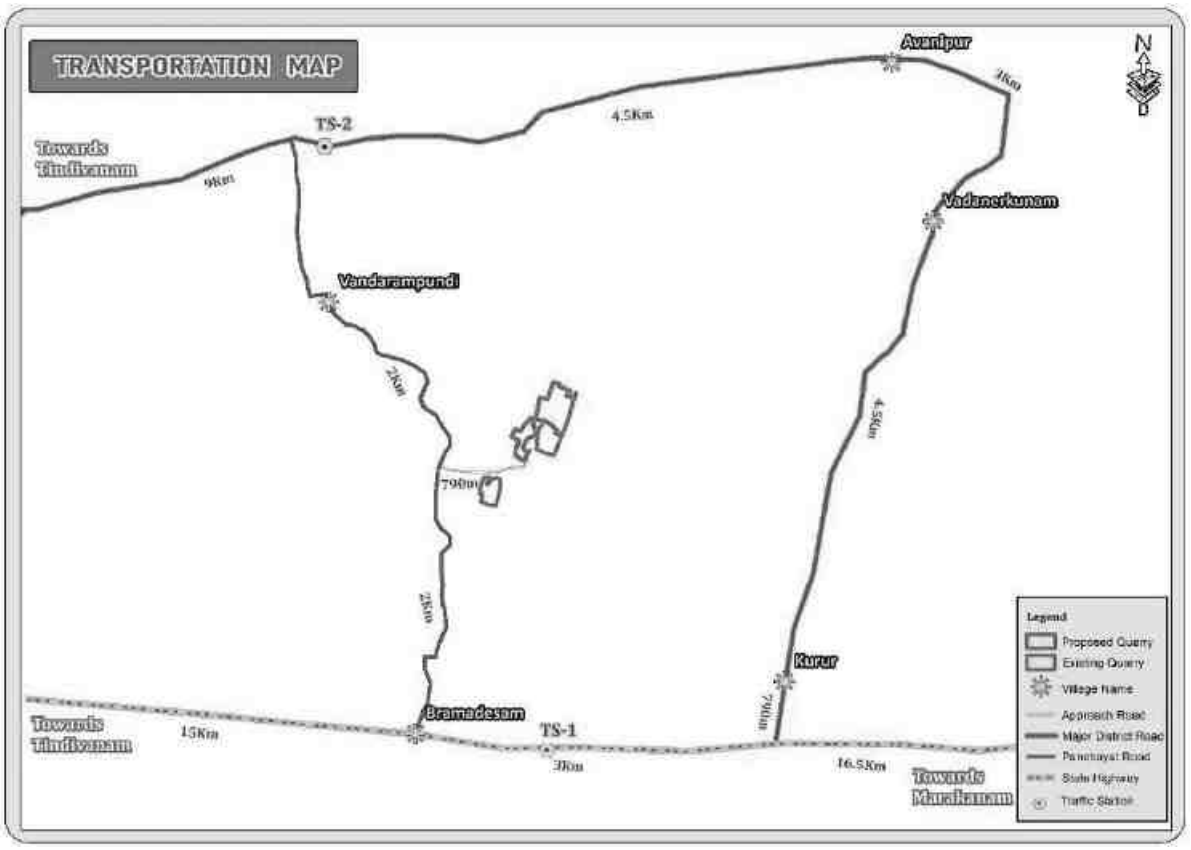


TABLE 2.14: SUMMARY OF TRAFFIC VOLUME

Route	Existing Traffic volume in PCU	Incremental traffic due to the project	Total traffic volume	Hourly Capacity in PCU as per IRC – 1960 guidelines
TS-1	900	234	1134	1500
TS-2	401	234	635	1200

Source: On-site monitoring analysis summary by GEMS FAE & TM

- Due to these project the existing traffic volume will not exceed
- As per the IRC 1960 this existing village road can handle 1,200 PCU in hour and Major district road can handle 1500 PCU in hour hence there will not be any conjunction due to this proposed transportation.

2.6.4 Mineral Beneficiation and Processing

There is no proposal for the mineral processing or ore bneficiation in any of the proposed project.

2.7 PROJECT REQUIREMENT (MAN POWER REQUIREMENT)

2.7.1 Water Source & Requirement

Detail of water requirements in KLD as given below:

TABLE 2.15: WATER REQUIREMENT FOR THE PROJECT

PROPOSAL – P1		
*Purpose	Quantity	Source
Dust Suppression	0.6 KLD	From Existing bore wells from nearby area
Green Belt development	0.5 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.4 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors.
Total	**1.5 KLD**	
PROPOSAL – P2		
*Purpose	Quantity	Source
Dust Suppression	1.0 KLD	Source
Green Belt development	0.3 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Domestic purpose	0.3 KLD	Rainwater accumulated in Mine Pit/ Water Tanker
Total	**1.6 KLD**	Water Tankers

Source: Prefeasibility report

* Drinking water will be sourced from Approved Water Vendors

2.7.2 Power and Other Infrastructure Requirement

No proposed projects require power supply for the mining operations. The quarrying activity is proposed during day time only (General Shift 8 AM – 5 PM, Lunch Break 1 PM – 2 PM). Electricity for use in office and other internal infrastructure will be obtained from SEB by respective project proponent.

No workshops are proposed inside the project area hence there will not be any process effluent generation from the project area. Domestic effluent from the mine office will be discharged to septic tank and soak pit. There is no toxic effluent expected to generate in the form of solid, liquid or gaseous form hence there is no requirement of waste treatment plant.

2.7.3 Fuel Requirement

High speed Diesel (HSD) will be used for mining machineries. Diesel will be brought from nearby Fuel Stations.
Average diesel consumption is around = 800 Liters of HSD / day per proposed project.'

2.7.4 Project Cost

TABLE 2.16: PROJECT COST OF PROPOSED PROJECTS

PROPOSAL – P1	
Project Cost	54,37,000/-
PROPOSAL – P2	
Project Cost	5,70,44,000/-

Source: Approved Mining Plan &Prefeasibility Report

2.8 EMPLOYMENT REQUIREMENT:

The following manpower's are proposed in the mining plan to carry out the day-to-day quarrying activities, the same employment is maintaining aimed at the proposed production target and also to comply with the statutory provisions of The Metalliferous mines regulations, 1961 for all the proposed projects.

TABLE 2.17: PROPOSED MANPOWER DEPLOYMENT

PROPOSAL – P1	
Mines Foreman	1
Mate/Blaster	1
Excavator Operator & Driver	6
Jack hammer operator	16
Secutiry	1
Labour & Helper	3
Co-Operator and Cleaner	6

Total	**34**
PROPOSAL – P2	
Mines Manager/Mines Foreman	1
Mate	1
Blaster	1
Jack hammer operator	12
Excavator operator	2
Wagon Drill Operator	2
Tippers Driver	8
Labour &Helper	4
Cleaner & co-operator	14
Security	3
Total	**48**

Source: Approved Mining Plans of respective Project

2.9 PROJECT IMPLEMENTATION SCHEDULE

The commercial operation will commence after the grant of Environmental Clearance. CTO a will be obtained from the Tamil Nadu State Pollution Control Board. The conditions imposed during the Environmental Clearance will be compiled before the start of mining operation.

TABLE 2.18: EXPECTED TIME SCHEDULE

Sl.No.	Particulars	Time Schedule (In Month)					Remarks if any
		1st	2nd	3rd	4th	5th	
1	Environmental Clearance						
3	Consent to Operate						Production Start Period
Time line may vary; subjected to rules and regulations /& other unforeseen circumstances							

Source: Anticipated based on Timelines framed in EIA Notification & CPCB Guidelines

3. DESCRIPTION OF ENVIRONMENT

3.0 GENERAL

This chapter presents a regional background to the baseline data at the very onset, which will help in better appreciation of micro-level field data, generated on several environmental and ecological attributes of the study area. The baseline status of the project environment is described section wise for better understanding of the broad-spectrum conditions. The baseline environment quality represents the background environmental scenario of various environmental components such as Land, Water, Air, Noise, Biological and Socio-economic status of the study area. Field monitoring studies to evaluate the base line status of the project site were carried out covering March 2023, April 2023 and May 2023 with CPCB guidelines. Environmental data has been collected with reference to cluster quarries by EHS 360 LABS PRIVATE LIMITED Approved by (Approved by ISO/IEC 17025:2017) Certified & MoEF Notified Laboratory, for the below attributes –

- Land
- Water
- Air
- Noise
- Biological
- Socio-economic status

Study Area

An area of 10 km radius (aerial distance) from the periphery of the cluster is considered for EIA study. The data collection has been used to understand the existing environment scenario around the cluster against which the potential impacts of the project can be assessed. The study area has been divided into two zones viz **core zone** and **buffer zone** where core zone is considered as cluster and buffer zone taken as 10km radius from the periphery of the Cluster. Both Core zone and Buffer zone is taken as the study area.

Study Period

The baseline study was conducted during the Pre-monsoon season i.e. March 2023 to May 2023.

Study Methodology

- The project area was surveyed in detail with the help of Total Station and the boundary pillars were picked up with the help of GPS. The boundary coordinates were superimposed on the satellite imagery to understand the relief of the area, besides Land use pattern of the area was studied through the Bhuvan (ISRO)
- Soil samples were collected and analysed for relevant physio-chemical characteristics, exchangeable Cations, nutrients & micro nutrients etc., in order to assess the impact due to mining activities and to recommend saplings for Greenbelt development.
- Ground water samples were collected during the study period from the existing bore wells, while surface water was collected from ponds in the buffer zone. The samples were analysed for parameters necessary to determine water quality (based on IS: 10500:2012 criteria) and those which are relevant from the point of view of environmental impact of the proposed mines.
- An onsite meteorological station was setup in cluster area, to collect data about wind speed, wind direction, temperature, relative humidity, rainfall and general weather conditions were recorded throughout the study period.
- In order to assess the Ambient Air Quality (AAQ), samples of ambient air were collected by installation of Respiratory Dust Samplers (RDS) for Fugitive dust, PM_{10} and SO_2, NO_X with gaseous attachments & Fine Dust Samplers (FDS) for $PM_{2.5}$ and other parameters as per NAAQ norms and analysed for primary air pollutants to work out the existing status of air quality.
- The Noise level measurements were also made at various locations in different intervals of time with the help of sound level meter to establish the baseline noise levels in the impact zone.
- Baseline biological studies were carried out to assess the ecology of the study area to study the existing flora and fauna pattern of the area.
- Socio-Economic survey was conducted at village and household level in the study area to understand the present socio-economic conditions and assess the extent of impact due to the proposed mining project.

The sampling methodologies for the various environmental parameters required for the study, frequency of sampling, method of samples analysis, etc., are given below Table 3.1.

TABLE 3.1: MONITORING ATTRIBUTES AND FREQUENCY OF MONITORING

Attribute	Parameters	Frequency of Monitoring	No. of Locations	Protocol
Land-use Land cover	Land-use Pattern within 10 km radius of the study area	Data from census handbook 2011 and from the satellite imagery	Study Area	Satellite Imagery Primary Survey
*Soil	Physio-Chemical Characteristics	Once during the study period	6 (2 core & 4buffer zone)	IS 2720 Agriculture Handbook - Indian Council of Agriculture Research, New Delhi
*Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study period	6 (2 surface water & 4 ground water)	IS 10500& CPCB Standards
Meteorology	Wind Speed Wind Direction Temperature Cloud cover Dry bulb temperature Rainfall	1 Hourly Continuous Mechanical/Automatic Weather Station	1	Site specific primary data& Secondary Data from IMD Station
*Ambient Air Quality	PM10 PM2.5 SO2 NOX Fugitive Dust	24 hourly twice a week (March 2023 to May 2023)	8 (2 core & 6 buffer)	IS 5182 Part 1-23 National Ambient Air Quality Standards, CPCB
*Noise Levels	Ambient Noise	Hourly observation for 24 Hours per location	8 (2 core & 6 buffer zone)	IS 9989 As per CPCB Guidelines
Ecology	Existing Flora and Fauna	Through field visit during the study period	Study Area	Primary Survey by Quadrate & Transect Study Secondary Data – Forest Working Plan
Socio Economic Aspects	Socio–Economic Characteristics, Population Statistics and Existing Infrastructure in the study area	Site Visit & Census Handbook, 2011	Study Area	Primary Survey, census handbook & need based assessments.

Source: On-site monitoring/sampling by EHS Lab Private Limited in association with GEMS

* All monitoring and testing have been carried out as per the Guidelines of CPCB and MoEF & CC.

3.1 LAND ENVIRONMENT

The main objective of this section is to provide a baseline status of the study area covering 10km radius around the proposed mine site so that temporal changes due to the mining activities on the surroundings can be assessed in future.

3.1.1 Land Use/ Land Cover

A visual interpretation technique has been adopted for land use classification based on the keys suggested in the chapter – V of the guidelines issued by NNRMS Bangalore & Level III classification with 1:50,000 scale for the preparation of land use mapping. Land use pattern of the area was studied through LISS III imagery of Bhuvan (ISRO). The 10 km radius map of study area was taken for analysis of Land use cover.

TABLE 3.2: LAND USE / LAND COVER TABLE 10 Km RADIUS

S.No	Classification	Area_Ha	Area_%
BUILTUP			
1	Urban	76.61	0.23
2	Rural	622.50	1.87
3	Mining	302.96	0.91
AGRICULTURAL LAND			
4	Crop Land	20583.23	61.97
5	Agricultural Plantation	3391.15	10.21
6	Fallow Land	2771.53	8.34
FOREST			
7	Forest Plantation	289.92	0.87
8	Scrub Forest	401.31	1.21
BARREN/WASTELAND			
9	Scrub Land	242.22	0.73
10	Salt Affected Area	1109.14	3.34
WATERBODIES			
11	Waterbodies	3423.67	10.31
		33214.24	100.00

Source: Survey of India Toposheet and Landsat Satellite Imagery

From the above table, pie diagram and land use map it is inferred that the majority of the land in the study area is Agriculture and Crop land (includes crop land) 72.18% followed by Built-up Lands – 3.01%, Scrub lands – 4.07%, and Water bodies 10.31%.

The total mining area within the study area is 302.90 ha i.e., 0.9%. The cluster area of 17.64.55 ha contributes about 5.84% of the total mining area within the study area. This small percentage of Mining Activities shall not have any significant impact on the environment.

3.1.2 Topography

The proposed project area is plain topography, covered with Gravel formation of 2m thickness; Massive Charnockite formation is found after 2m Gravel formation which is clearly inferred from the existing quarry pits.

3.1.3 Drainage Pattern of the Area

Drainage pattern are created by stream erosion over time that reveals characteristics of the kind of rocks and geological structures in a landscape region drained by streams.

Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin. They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land.

Dendritic patterns, which are by far the most common, develop in areas where the rock (or unconsolidated material) beneath the stream has no particular fabric or structure and can be eroded equally easily in all directions.

There are no streams, canals or water bodies crossing within the project area. The drainage pattern of the area is dendritic – sub dendritic.

3.1.4 Seismic Sensitivity

The proposed project site falls in the seismic Zone II, low damage risk zone as per BMTPC, Vulnerability Atlas of Seismic zone of India IS: 1893 – 2002. The project area falls in the hard rock terrain on the peninsular shield of south India which is highly stable.
(Source: https://moes.gov.in/writereaddata/files/LS_EN_20032020_385.pdf)

3.1.5 Environmental Features in the Study Area

There is no Wildlife Sanctuaries, National Park and Archaeological monuments within project area. No Protected and Reserved Forest area is involved in the project area. Therefore, there will be no need to acquisition/diversion of forest land. The details related to the environment sensitivity around the proposed mine lease area i.e. 10 km radius, are given in the below Table 3.3.

FIGURE 3.2: LAND USE LAND COVER MAP 10KM RADIUS

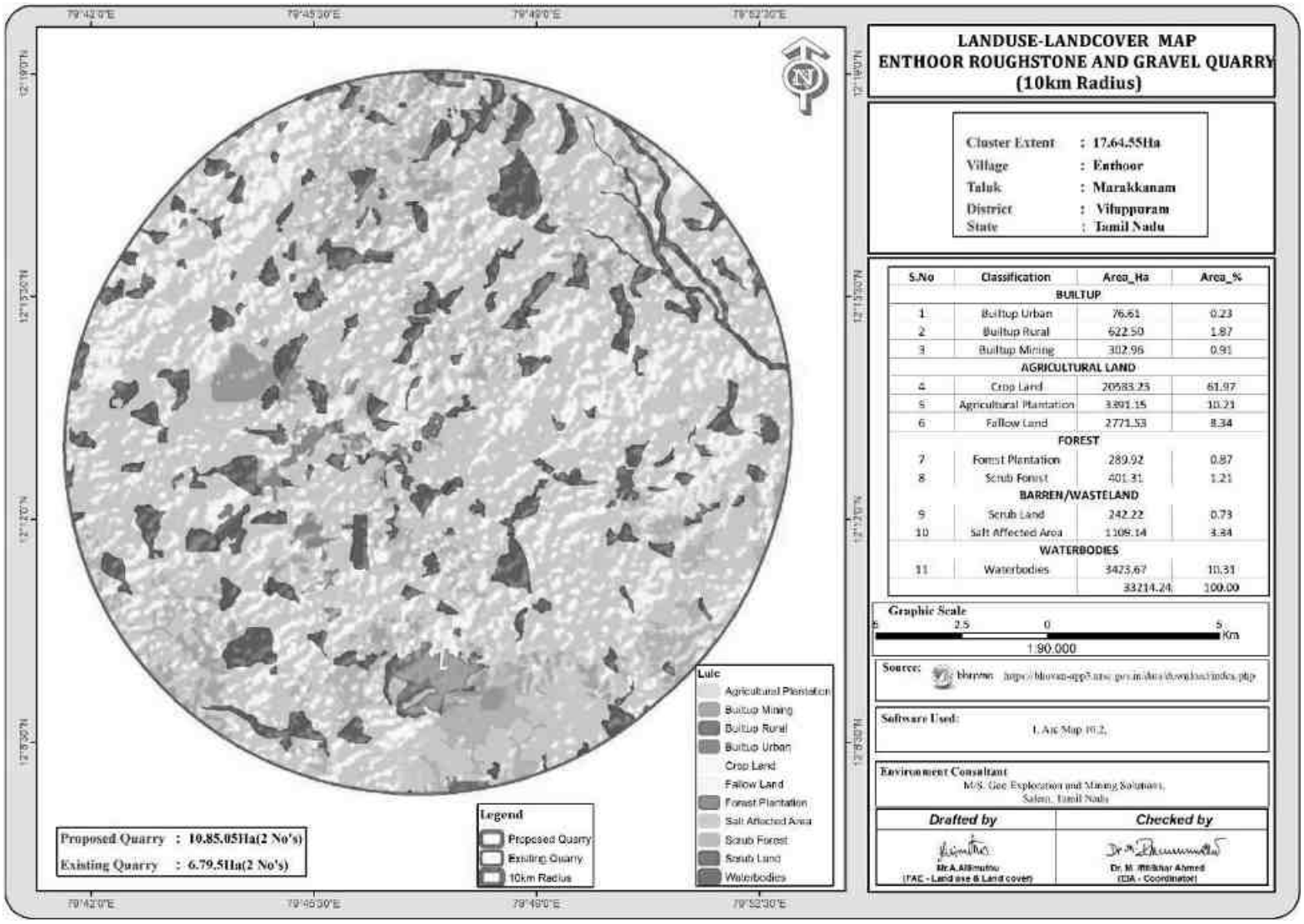


TABLE 3.3: DETAILS OF ENVIRONMENT SENSITIVITY AROUND THE CLUSTER

Sl.No	Sensitive Ecological Features	Name	Arial Distance in km from Cluster
1	National Park / Wild life Sanctuaries	None	Nil within 10km Radius
2	Reserve Forest	Sevur	4.18 km Northwest
3	Tiger Reserve/ Elephant Reserve/ Biosphere Reserve	None	Nil within 10Km Radius
4	Critically Polluted Areas	None	Nil within 10km Radius
5	Mangroves	None	Nil within 10km Radius
6	Mountains/Hills	None	Nil within 10km Radius
7	Notified Archaeological Sites	None	Nil within 10km Radius
8	Industries/ Thermal Power Plants	None	Nil within 10km Radius
9	Defence Installation	None	Nil within 10km Radius

Source: Survey of India Toposheet

TABLE 3.4: NEARBY WATER BODIES FROM THE PROPOSED PROJECT SITE

PROPOSAL – P1		
Sl.No	**NAME**	**DISTANCE & DIRECTION**
1	odai	500m_NE
2	Tank	260m SW
3	Kunnapakkam Lake	800m_E
4	Ariyathangal Lake	860m_SW
5	Endur Lake	1.3Km_S
6	Bramaddesam Lake	3Km_SW
7	Munnur Lake	4Km_SE
8	Nallavur Lake	8.5Km_SW
9	Puthunagara Lake	8.5Km_SW
10	Nolambur Lake	6Km_NW
11	Kilsevur Lake	4Km_NW
12	Ongur Stream	8.5Km_NE
PROPOSAL – P2		
Sl.No	**NAME**	**DISTANCE & DIRECTION**
1	odai	230m_E
2	Tank	470m_SW
3	Kunnapakkam Lake	970m_SW
4	Ariyathangal Lake	1.1Km_SW
5	Endur Lake	1.5Km_S
6	Bramaddesam Lake	3.2Km_SW
7	Munnur Lake	3.8Km_SE
8	Nallavur Lake	9Km_SW
9	Puthunagara Lake	9Km_SW
10	Nolambur Lake	6.3Km_NW
11	Kilsevur Lake	4.3Km_NW
12	Ongur Stream	8Km_NE

Source: Village Cadastral Map and Field Survey

3.1.6 Soil Environment

Soil quality of the study area is one of the important components of the land environment. The composite soil samples were collected from the study area and analysed for different parameters. The locations of the monitoring sites are detailed in Table 3.5 and Figure 3.3.

The objective of the soil sampling is -

To determine the baseline soil characteristics of the study area; study the impact of proposed activity on soil characteristics and study the impact on soil more importantly agriculture production point of view.

TABLE 3.5: SOIL SAMPLING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	S-1	Core Zone	Project Area	12°13'24.29"N 79°47'13.66"E
2	S-2	Core Zone	Project Area	12°13'32.36"N 79°47'27.45"E
3	S-3	Budderi	2.2km NW	12°14'8.10"N 79°46'16.84"E
4	S-4	Arungunam	4.3km SW	12°13'0.90"N 79°44'55.68"E
5	S-5	Akshipakkam	3.8km North	12°15'37.81"N 79°47'34.27"E
6	S-6	Alanguppam	3.4km SE	12°12'0.42"N 79°48'41.30"E

Source: On-site monitoring/sampling by EHS 360 Lab Private Limited in association with GEMS

Methodology –

For studying soil quality, sampling locations were selected to assess the existing soil conditions in and around the project site representing various land use conditions. The samples were collected by auger boring into the soil up to 90-cm depth. Six (6) locations were selected for soil sampling on the basis of soil types, vegetative cover, industrial & residential activities including infrastructure facilities, which would accord an overall idea of the soil characteristics. The samples were analysed for physical and chemical characteristics. The samples were sent to laboratory for analysis. The samples were filled in Polythene bags, coded and sent to laboratory for analysis and the details of methodology in respect are given in below Table 3.6.

TABLE 3.6: METHODOLOGY OF SAMPLING COLLECTION

Particulars	Details
Frequency	One grab sample from each station-once during the study period
Methodology	Composite grab samples of the topsoil were collected from 3 depths, and mixed to provide a representative sample for analysis. They were stored in airtight Polythene bags and analysed at the laboratory.

Source: On-site monitoring/sampling by EHS 360 Lab Private Limited in association with GEMS

Soil Testing Result –

The samples were analysed as per the standard methods prescribed in "Soil Chemical Analysis (M.L. Jackson, 1967) & Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India". The important properties analysed for soil are bulk density, porosity, infiltration rate, pH and Organic matter, kjeldahi Nitrogen, Phosphorous and Potassium. The standard classifications of soil are presented below in Figure 3.4 and the physico-chemical characteristics of the soil & Test Results in Table 3.7.

FIGURE 3.3: SOIL SAMPLING LOCATIONS AROUND 10 KM RADIUS

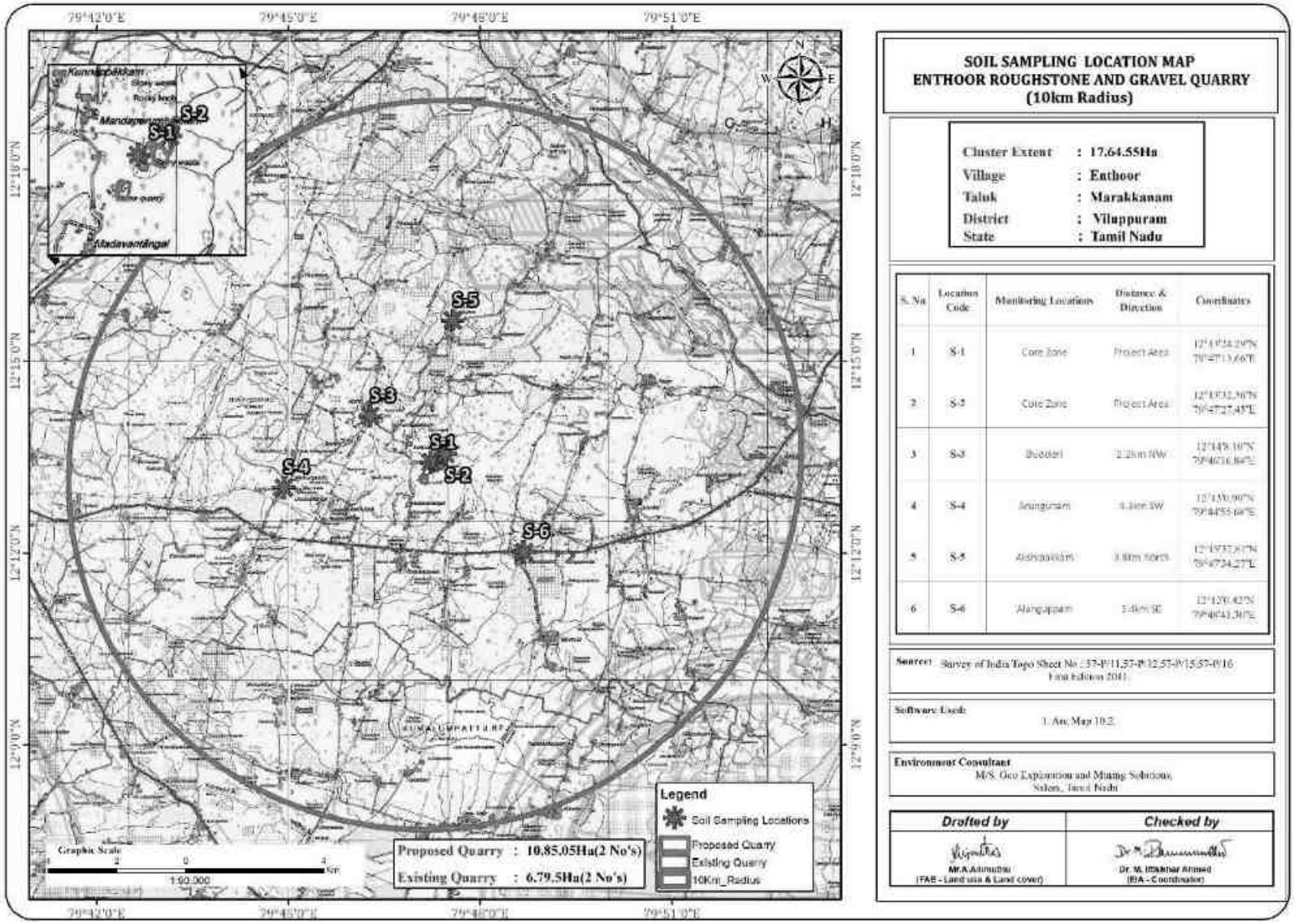


FIGURE 3.4: SOIL MAP

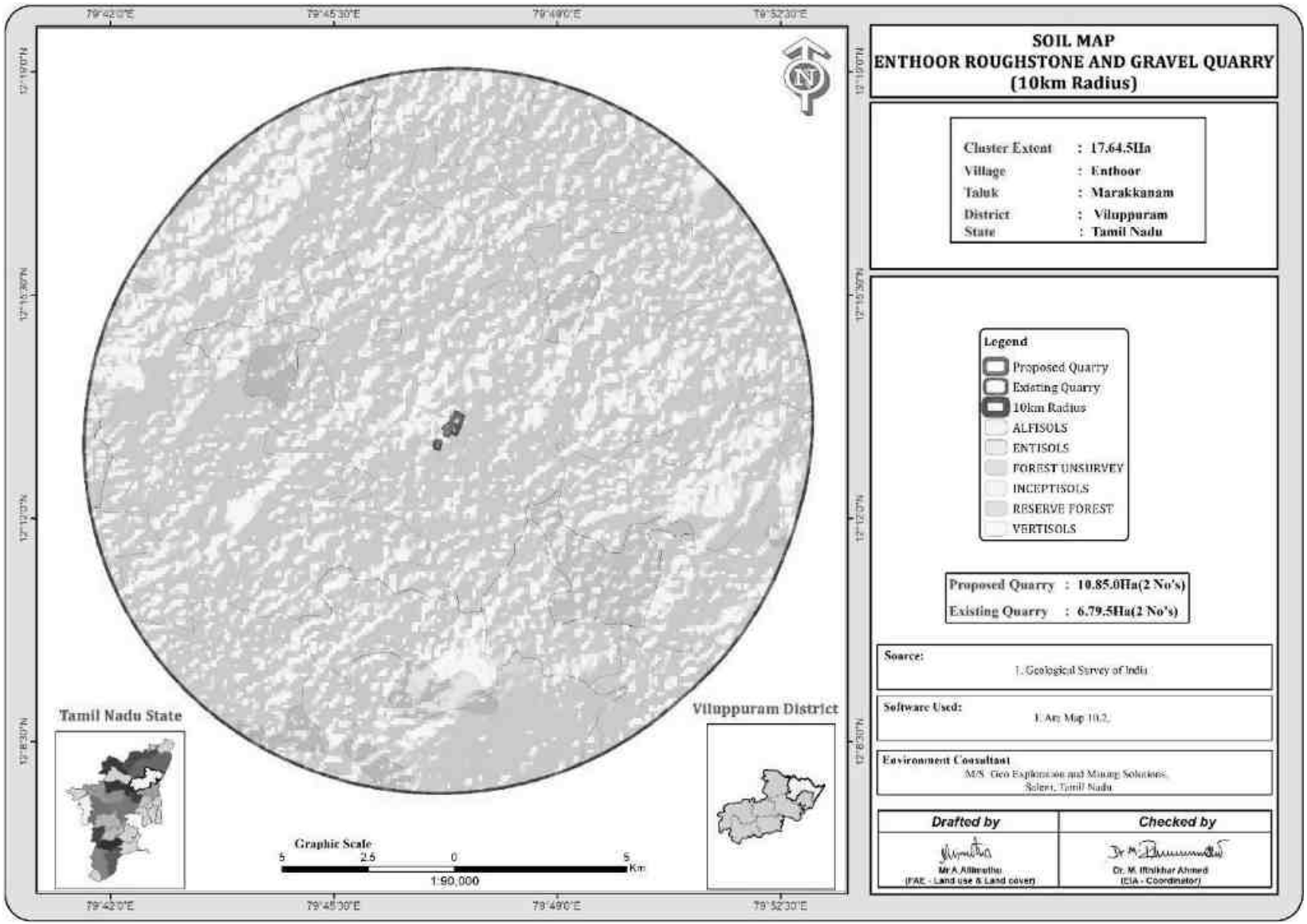


TABLE 3.7: SOIL QUALITY OF THE STUDY AREA

	Parameter	Unit	S-1 Project Area	S-2 Ponakani	S-3 Chettipalayam	S-4 Edayarpalayam	S-5 Karachery	S-6 Tegani
1	Soil Colour	-	Brown	Dark brown	Brown	Brown	Brown	Brown
2	pH @ 25°C	-	7.52	8.03	7.85	8.21	7.63	7.84
3	Conductivity @ 25°C	µmhos/cm	465	602	587	402	474	578
4	Water Holding Capacity	%	37.3	44.5	54.1	41.7	42.4	39.8
5	Bulk Density	g/cm^3	1.04	1.08	0.99	1.15	1.12	1.07
6	Porosity	%	40.7	43.4	37.9	38.7	30.1	26.5
7	Calcium as Ca	mg/Kg	110	99.8	82.4	121	115	117
8	Magnesium as Mg	mg/Kg	46.2	59.8	39.8	63.5	58.6	57.4
9	Chloride as Cl	mg/Kg	112	109	118	124.5	121.5	121.5
10	Soluble Sulphate as SO_4	%	0.014	0.0012	0.026	0.0032	0.0029	0.0028
11	Total Phosphorus as P	mg/Kg	0.89	1.24	1.2	1.01	2.04	2.14
12	Total Nitrogen as N	mg/Kg	221	378	455	386	463	478
13	Organic Matter	%	1.73	1.56	2.68	2.31	2.27	2.27
14	Organic Carbon	%	1.04	0.91	1.56	1.34	1.32	1.32
15	**Texture :**							
16	Clay	%	28.9	33.5	31.4	28.9	32.5	31.7
17	Sand	%	36.2	31.8	31.7	32.6	34.8	35.6
18	Silt	%	34.9	34.7	36.9	38.5	32.7	32.7
19	Manganese as Mn	mg/Kg	16.2	20.1	22.4	20.6	19.2	18.4
20	Zinc as Zn	mg/Kg	0.78	1.08	1.07	1.62	1.32	1.14
21	Boron as B	mg/Kg	1.21	1.45	0.78	1.14	1.12	1.13
22	Potassium as K	mg/Kg	28.2	18.7	32.3	36.4	28.9	20.1
23	Cadmium as Cd	mg/Kg	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
24	Total Chromium as Cr	mg/Kg	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
25	Copper as Cu	mg/Kg	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)	BDL (DL : 1.0 mg/kg)
26	Lead as Pb	mg/Kg	0.84	0.45	1.04	1.13	0.76	1.04
27	Iron as Fe	mg/Kg	1.86	1.85	1.45	1.47	2.21	1.32
28	Cation Exchange Capacity	meq/100g of soil	33.2	28.7	29	34.6	43.2	36.8

Interpretation & Conclusion

Physical Characteristics –

The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The soil texture found in the study area is Clay to Sandy Loam Soil and Bulk Density of Soils in the study area varied between 0.99 – 1.15 g/cc. The Water Holding Capacity and Porosity of the soil samples is found to be medium i.e. ranging from 37.3 to 54.1 %.

Chemical Characteristics –

- The nature of soil is slightly alkaline to strongly alkaline with pH range 7.52 to 8.21
- The available Nitrogen content range between 221 to 478 kg/ha
- The available Phosphorus content range between 0.89 to 2.14 kg/ha
- The available Potassium range between 18.7 to 36.4 mg/kg

3.2 WATER ENVIRONMENT

The water resources, both surface and groundwater play a significant role in the development of the area. The purpose of this study is to assess the water quality characteristics for critical parameters and evaluate the impacts on agricultural productivity, domestic community usage, recreational resources and aesthetics in the vicinity. The water samples were collected and transported as per the norms in pre-treated sampling cans to laboratory for analysis.

3.2.1 Surface Water Resources:

Bhavani River is the major surface water body in the study area and the rainfall over the area is moderate, the rainwater storage in open wells and trenches are in practice over the area and the stored water acts as source of drinking water for few months after rainy season.

3.2.2 Ground Water Resources:

Groundwater occurs in all the crystalline formations of oldest Achaeans and Recent Alluvium. The occurrence and behaviour of groundwater are controlled by rainfall, topography, geomorphology, geology, structures etc.

Ground water occurring in pheratic conditions in weathered and fractured gneiss rock formation. The weathering is controlled by the intensity of weathering and fracturing. Dug wells as wells as bore wells are more common ground water abstraction structures in the area. The diameter of the dug well is in the range of 7 to 10 m and depth of dug wells range from 7.2 to 13 m bgl. The dug wells yield up to 1 lps in summer months and few wells remains dry. The yield is adequate for irrigation for one or two crops in monsoon period.

3.2.3 Methodology

Reconnaissance survey was undertaken and monitoring locations were finalized based on;

- Drainage pattern;
- Location of Residential areas representing different activities/likely impact areas; and
- Likely areas, which can represent baseline conditions

Two (2) surface water and Four (4) ground water samples were collected from the study area and were analysed for physio-chemical, heavy metals and bacteriological parameters in order to assess the effect of mining and other activities on surface and ground water. The samples were analysed as per the procedures specified by CPCB, IS-10500:2012 and 'Standard methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA). The water sampling locations are given in Table 3.8 and shown as Figure 3.5.

TABLE 3.8: WATER SAMPLING LOCATIONS

S.NO	LOCATION CODE	LOCATIONS	DISTANCE & DIRECTION	COORDINATES
SURFACE WATER				
1	SW-1	Enthoor Lake	1.7km SE	12°12'23.08"N79°47'26.81"E
2	SW-2	Tank Near Vadanerkunam	3.2km NE	12°14'34.17"N 79°49'0.04"E
GROUND WATER				
3	WW-1	Near Project Area	400m West	12°13'26.35"N 79°47'0.46"E
4	WW-2	Arungunam	4.5km SW	12°13'0.80"N 79°44'44.90"E
5	BW-1	Near Project Area	250m SE	12°13'13.10"N79°47'19.19"E
6	BW-2	Akshipakkam	3.5km North	12°15'31.83"N 9°47'31.46"E

Source: On-site monitoring/sampling by EHS 360 Lab Private Limited in association with GEMS

FIGURE 3.5: WATER SAMPLING LOCATIONS AROUND 10 KM RADIUS

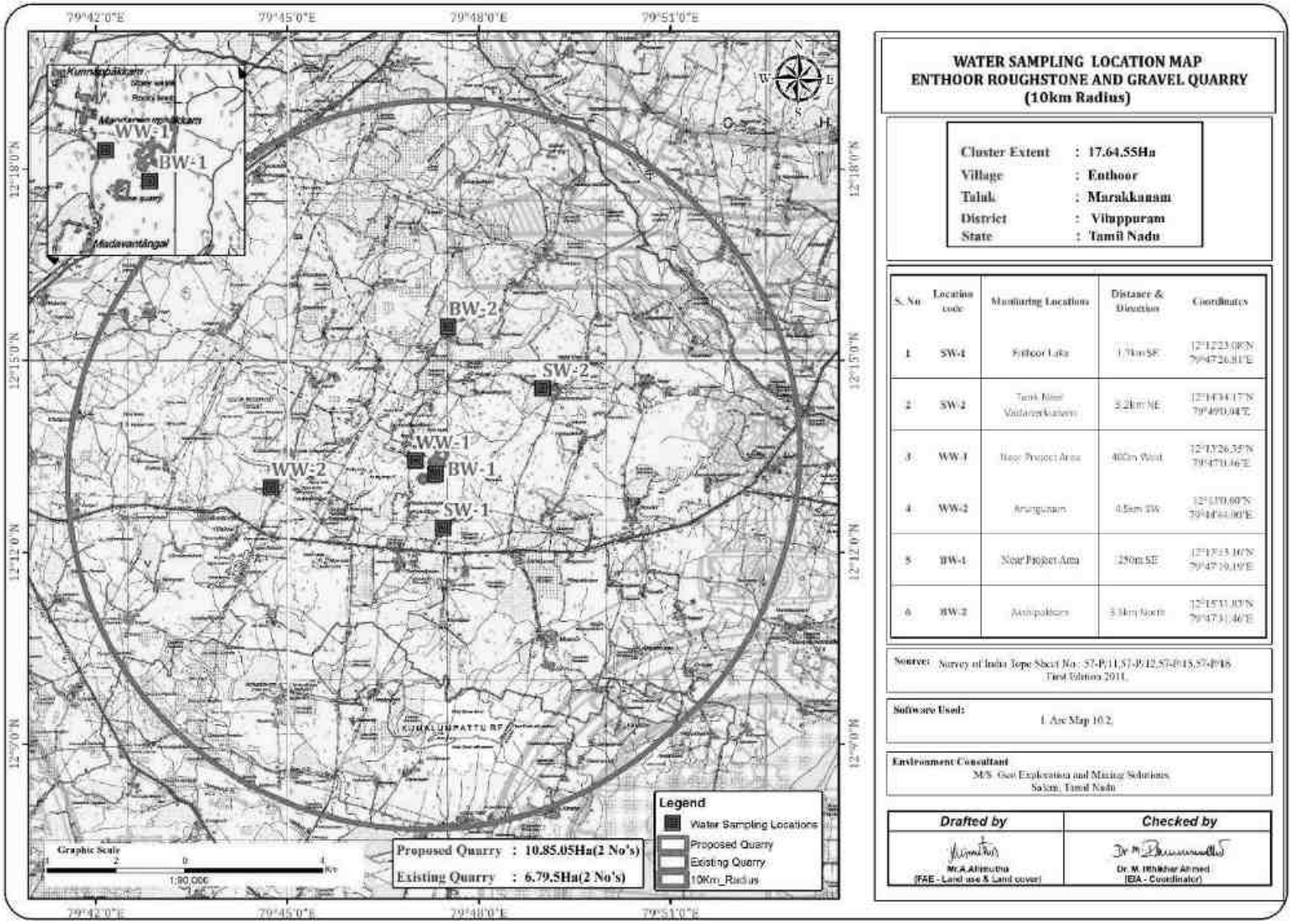


TABLE 3.9: GROUND WATER SAMPLING RESULTS

S.No	Parameters	Units	RESULTS				Standards as Per IS 10500: 2012	
			WW1	WW2	BW1	BW2	Acceptable limit	Permissible limit
1	Color	Hazen	< 5	< 5	5	5	5	5
2	Odour	-	Agreeable				Agreeable	Agreeable
3	Taste	-	Agreeable				Agreeable	Agreeable
4	pH@ 25°C	-	7.21	7.11	7.52	7.37	6.5-8.5	6.5-8.5
5	Electrical Conductivity @ 25°C	µs/cm	852	982	899	904	Not specified	Not specified
6	Turbidity	NTU	1.0	1.0	2.6	1.0	1	1
7	TDS	mg /l	502	579	530	533	500	500
8	Total Hardness	mg/l	192	204	184	180	200	200
9	Calcium as Ca	mg/l	43.2	49.6	36.8	38.4	75	75
10	Magnesium as Mg	mg/l	20.4	19.5	22.3	20.4	30	30
11	Total Alkalinity	mg/l	132.5	179	148	156	200	200
12	Chloride as Cl-	mg/l	178	193	169.2	162.6	250	250
13	Sulphate as SO4-	mg/l	56.9	52.1	51.3	58.4	200	200
14	Iron as Fe	mg/l	0.13	0.16	0.17	0.19	0.3	0.3
15	Free Residual Cl	mg/l	BDL (DL:0.1)				0.2	0.2
16	Fluoride as F	mg/l	0.22	0.23	0.24	0.21	1.0	1.0
17	Nitrates as NO3	mg/l	6.	9.6	3.2	6.6	45	45
18	Copper as Cu	mg/l	BDL (DL:0.01 mg/l)				0.05	0.05
19	Manganese as Mn	mg/l	BDL (DL:0.02 mg/l)				0.1	0.1
20	Mercury as Hg	mg/l	BDL (DL:0.0005 mg/l)				0.001	0.001
21	Cadmium as Cd	mg/l	BDL (DL:0.001 mg/l)				0.003	0.003
22	Selenium as Se	mg/l	BDL (DL:0.005 mg/l)				0.01	0.01
23	Aluminium as Al	mg/l	BDL (DL:0.005 mg/l)				0.03	0.03
24	Lead as Pb	mg/l	BDL (DL:0.005 mg/l)				0.01	0.01
25	Zinc as Zn	mg/l	BDL (DL: 0.05 mg/l)				5	5
26	Total Chromium	mg/l	BDL (DL: 0.02 mg/l)				0.05	0.05
27	Boron as B	mg/l	BDL(DL : 0.05 mg/l)				0.5	0.5
28	Mineral Oil	mg/l	BDL (DL: 0.01 mg/l)				0.5	0.5
29	Phenolic Compounds	mg/l	BDL (DL:0.0005 mg/l)				0.001	0.001
30	Anionic Detergents	mg/l	BDL (DL:0.01 mg/l)				0.2	0.2
31	Cyanide as CN	mg/l	BDL (DL:0.01 mg/l)				0.05	0.05
32	Barium as Ba	mg/l	BDL(DL:0.05 mg/l)				0.7	0.7
33	Ammonia	mg/l	BDL (DL:0.01 mg/l)				0.5	0.5
34	Sulphide as H_2S	mg/l	BDL (DL:0.01 mg/l)				0.05	0.05
35	Molybdenum	mg/l	BDL (DL:0.02 mg/l)				0.07	0.07
36	Total Arsenic	mg/l	BDL (DL:0.005 mg/l)				0.01	0.01
37	Total Suspended Solids	Mg/l	BDL (DL:1.0 mg/l)				-	-
38	Total Coliform	MPN/ 100ml	96	211	163	167	Shall not be detectable in any100 ml	Shall not be detectable in any100 ml
39	E-Coli		< 1.8	< 1.8	< 1.8	< 1.8		

* IS: 10500:2012-Drinking Water Standards; # within the permissible limit as per the WHO Standard. The water can be used for drinking purpose in the absence of alternate sources. Note: SW- Surface water, GW – Ground water

TABLE 3.10: SURFACE WATER SAMPLING RESULTS

Sl. No.	Parameter	Unit	RESULT		CPCB Designated Best Use
			SW1	SW2	
1	Color	Hazen	8	6	300
2	Odour	-	Agreeable	Agreeable	Not specified
3	pH@ 25ºC	-	7.21	7.38	6.5 – 8.5
4	Electrical Conductivity @ 25°C	µs/cm	1185	1152	
5	Turbidity	NTU	3.9	4.5	Not specified
6	Total Dissolved Solids	mg /l	699	680	1500
7	Total Hardness as $CaCO_3$	mg/l	224	236	Not specified
8	Calcium as Ca	mg/l	59.3	51.3	Not specified
9	Magnesium as Mg	mg/l	18.4	26.2	Not specified
10	Total Alkalinity as $CaCO_3$	mg/l	198	218	Not specified
11	Chloride as Cl^-	mg/l	232	196	600
12	Sulphate as SO_4^-	mg/l	75.6	86.7	400
13	Iron as Fe	mg/l	0.13	0.21	50
14	Free Residual Chlorine	mg/l	BDL (DL:0.1)	BDL (DL:0.1)	400
15	Fluoride as F	mg/l	0.38	0.21	1.5
16	Nitrates as NO_3	mg/l	8.6	11.2	50
17	Copper as Cu	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	1.5
18	Manganese as Mn	mg/l	BDL (DL:0.02)	BDL (DL:0.02)	Not specified
19	Mercury as Hg	mg/l	BDL (DL:0.0005)	BDL (DL:0.0005)	Not specified
20	Cadmium as Cd	mg/l	BDL (DL:0.001)	BDL (DL:0.001)	0.01
21	Selenium as Se	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	Not specified
22	Aluminium as Al	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	Not specified
23	Lead as Pb	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	0.1
24	Zinc as Zn	mg/l	BDL(DL : 0.05)	BDL(DL : 0.05)	15
25	Total Chromium	mg/l	BDL(DL : 0.02)	BDL(DL : 0.02)	0.05
26	Boron as B	mg/l	BDL(DL : 0.05)	BDL(DL : 0.05)	Not specified
27	Mineral Oil	mg/l	BDL(DL : 0.01)	BDL(DL : 0.01)	Not specified
28	Phenolic Compounds as C_6H_5OH	mg/l	BDL (DL:0.0005)	BDL (DL:0.0005)	0.005
29	Anionic Detergents as MBAS	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	Not specified
30	Cyanide as CN	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	0.05
31	Biological Oxygen Demand, 3 days @ 27°C		14.3	10.2	3
32	Chemical Oxygen Demand		47	39	Not specified
33	Dissolved Oxygen		5.3	5.6	4
34	Barium as Ba	mg/l	BDL(DL:0.05)	BDL(DL:0.05)	300
35	Ammonia (as Total Ammonia-N)	mg/l	2.3	2.9	Not specified
36	Sulphide as H_2S	mg/l	BDL (DL:0.01)	BDL (DL:0.01)	Not specified
37	Molybdenum as Mo	mg/l	BDL (DL:0.02)	BDL (DL:0.02)	Not specified
38	Total Arsenic as As	mg/l	BDL (DL:0.005)	BDL (DL:0.005)	0.2
39	Total Suspended Solids	mg/l	7.9	7.9	-
40	Total Coliform	MPN/ 100ml	598	516	5000
41	E-Coli		52	97	Not specified

3.2.4 Interpretation& Conclusion

Surface Water

Ph:

The pH varied from 7.21 to 7.38 while turbidity found within the standards (Optimal pH range for sustainable aquatic life is 6.5 to 8.5 pH).

Total Dissolved Solids:

Total Dissolved Solids varied from 680 to 699 mg/l, the TDS mainly composed of carbonates, bicarbonates, Chlorides, phosphates and nitrates of calcium, magnesium, sodium and other organic matter.

Other parameters:

Chloride content is 196 – 232 mg/l. Nitrates varied from 8.6 to 11.2 mg/l, while sulphates varied from 75.6 to 86.7 mg/l.

Ground Water

The pH of the water samples collected ranged from 7.11 to 7.52 and within the acceptable limit of 6.5 to 8.5. pH, Sulphates and Chlorides of water samples from all the sources are within the limits as per the Standard. On Turbidity, the water samples meet the requirement. The Total Dissolved Solids were found in the range of 502 - 579 mg/l in all samples. The Total hardness varied between 180 – 204 mg/l for all samples.

On Microbiological parameters, the water samples from all the locations meet the requirement. The parameters thus analysed were compared with IS 10500:2012 and are well within the prescribed limits.

3.2.5 Hydrology and Hydrogeological studies

The district is underlain by hard rock formation fissured and fractured crystalline rocks constitute the important aquifer systems in the district. Geophysical prospecting was carried out in that area by SSRMP-80 Instrument by qualified Geo physicist with the help of IGIS software and it was inferred that the low resistance encountered at the depth between **65-68m**. The maximum depth proposed out of proposed projects is **45m BGL**. Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area. There is no necessity of stream, channel diversion due to these proposed projects.

During the rainy season there is a possibility of collection of seepage water from the subsurface levels which will be collected and stored in the mine sump pits and will be used for dust suppression and greenbelt development and during the end of the life of the mine this collected water will act as a temporary reservoir.

TABLE 3.11: PRE MONSOON WATER LEVEL OF OPEN WELLS 1 KM RADIUS

Station Code	Water Level in Meters bgl				Latitude	Longitude
	March 2023	April 2023	May 2023	Average		
OW1	11	11.6	12.2	11.6	12° 13' 37.86"N	79° 47' 05.63"E
OW2	11.2	11.8	12.4	11.8	12° 13' 54.60"N	79° 47' 09.30"E
OW3	11.5	12.1	12.7	12.1	12° 13' 47.71"N	79° 47' 35.60"E
OW5	11.4	12	12.6	12	12° 13' 31.10"N	79° 47' 39.32"E
OW4	11.3	11.9	12.5	11.9	12° 13' 18.93"N	79° 47' 39.97"E
OW6	11.7	12.3	12.9	12.3	12° 12' 59.30"N	79° 47' 33.40"E
OW7	11.6	12.2	12.8	12.2	12° 12' 53.14"N	79° 47' 09.50"E
OW8	11.9	12.5	13.1	12.5	12° 13' 08.24"N	79° 46' 47.54"E
OW9	11.8	12.4	13	12.4	12° 13' 26.48"N	79° 46' 42.41"E
OW10	12	12.6	13.2	12.6	12° 13' 40.34"N	79° 46' 46.64"E

Source: Onsite monitoring data

TABLE 3.12: PRE MONSOON WATER LEVEL OF BOREWELLS 1 KM RADIUS

Station Code	Water Level in Meters bgl				Latitude	Longitude
	March 2023	April 2023	May 2023	Average		
BW1	56	56.6	57.2	56.6	12° 13' 41.54"N	79° 46' 54.46"E
BW2	56.8	57.4	58	57.4	12° 13' 48.75"N	79° 47' 12.07"E
BW3	56.5	57.1	57.7	57.1	12° 13' 46.70"N	79° 47' 41.10"E
BW4	56.6	57.2	57.8	57.2	12° 13' 25.65"N	79° 47' 52.68"E
BW5	56.7	57.3	57.9	57.3	12° 13' 00.23"N	79° 47' 44.09"E
BW6	56.9	57.5	58.1	57.5	12° 12' 56.10"N	79° 47' 08.21"E
BW7	57	57.6	58.2	57.6	12° 13' 19.12"N	79° 46' 54.30"E

Source: Onsite monitoring data

FIGURE 3.6: OPEN WELL CONTOUR MAP – MARCH 2023

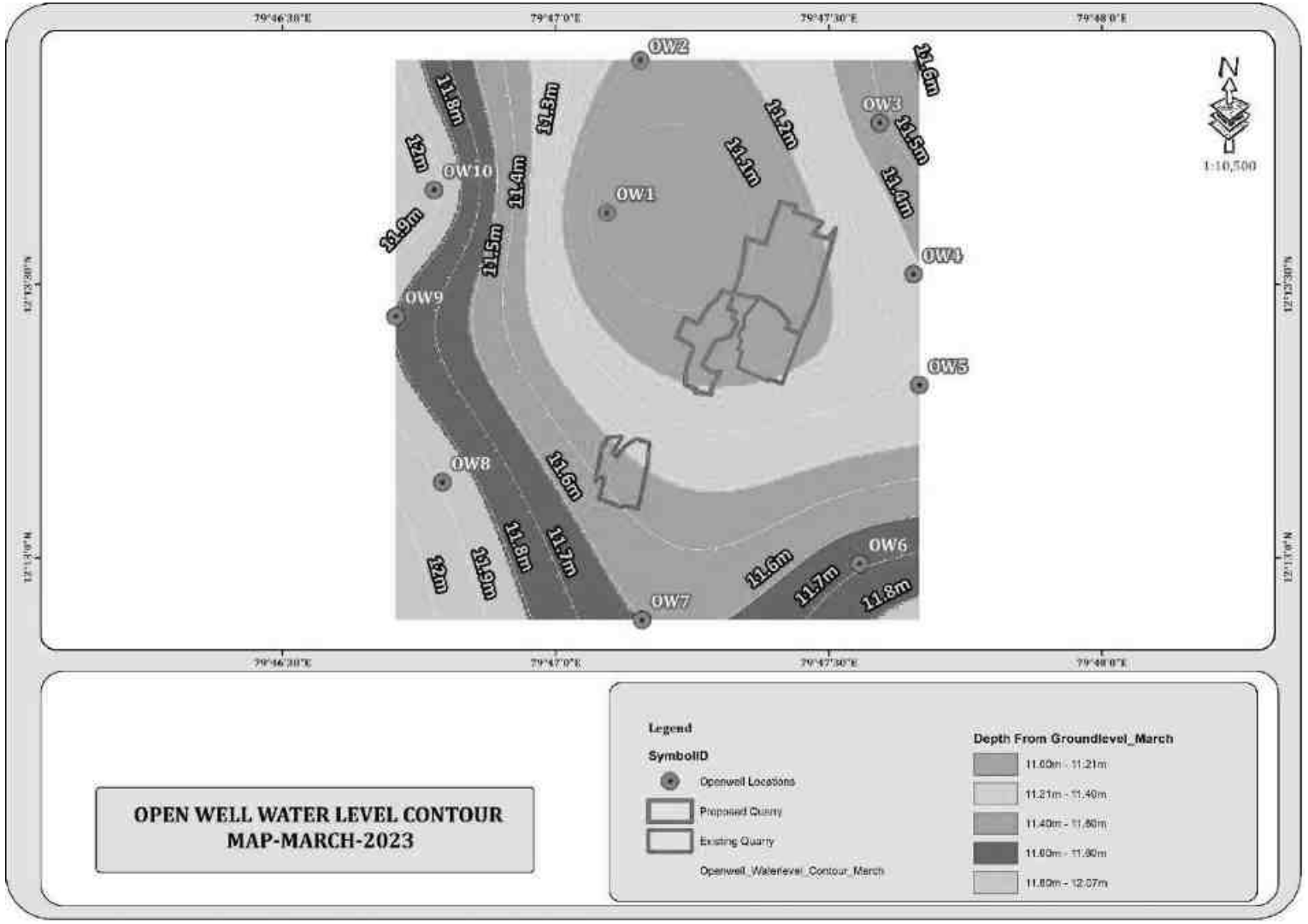


FIGURE 3.7: OPEN WELL CONTOUR MAP – APRIL 2023

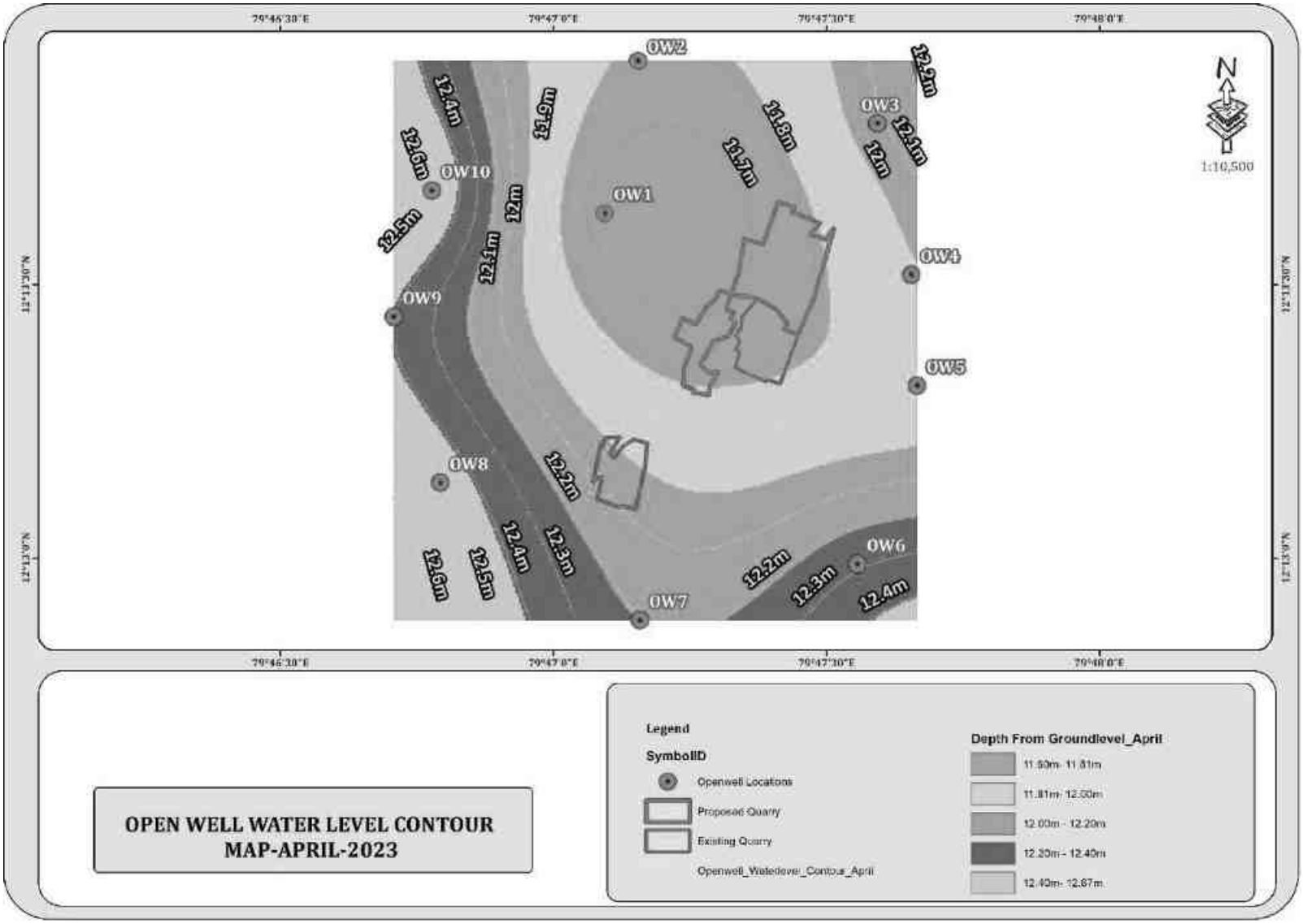


FIGURE 3.8: OPEN WELL CONTOUR MAP – MAY 2023

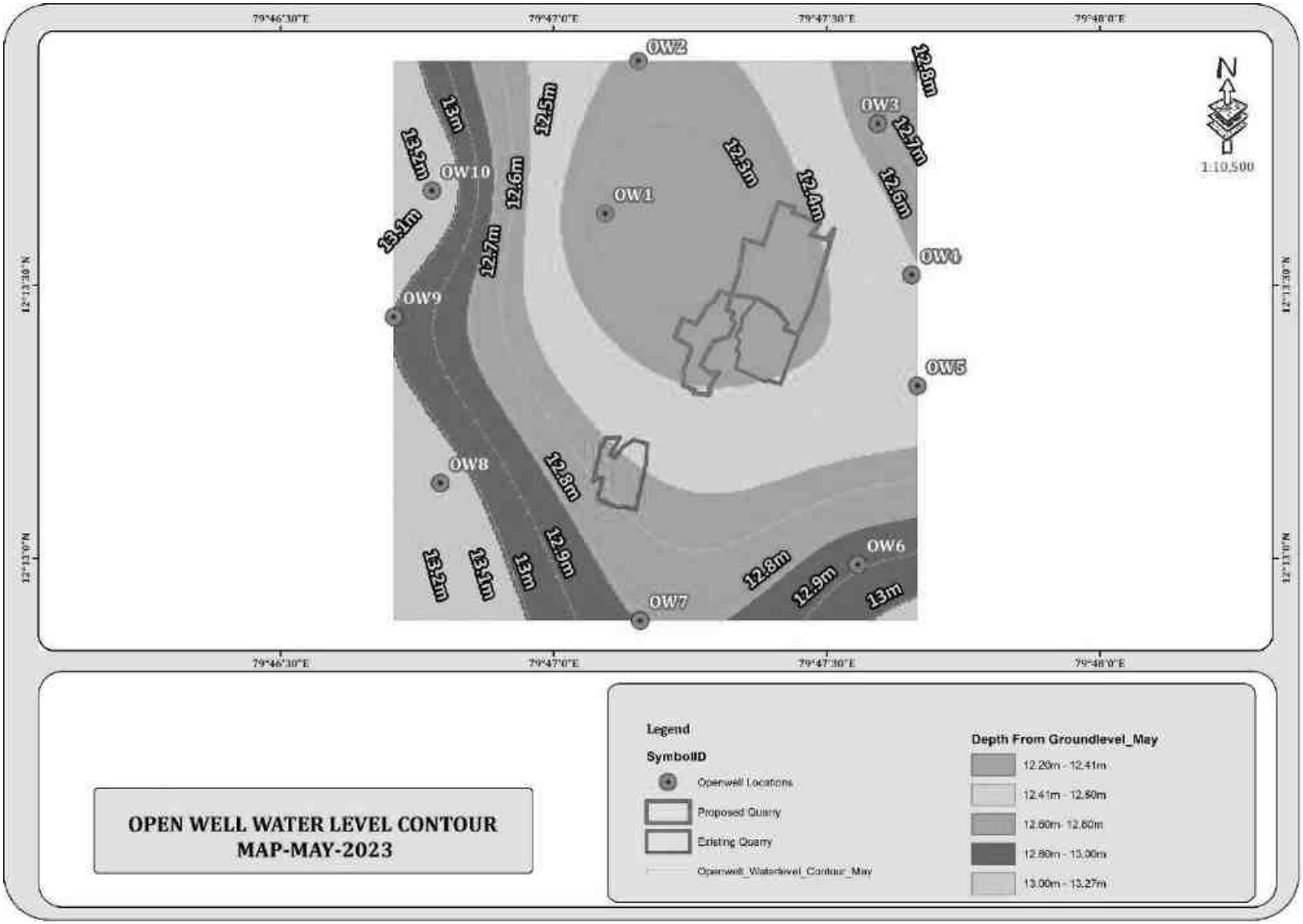


FIGURE 3.9: BOREWELL CONTOUR MAP – MARCH 2023

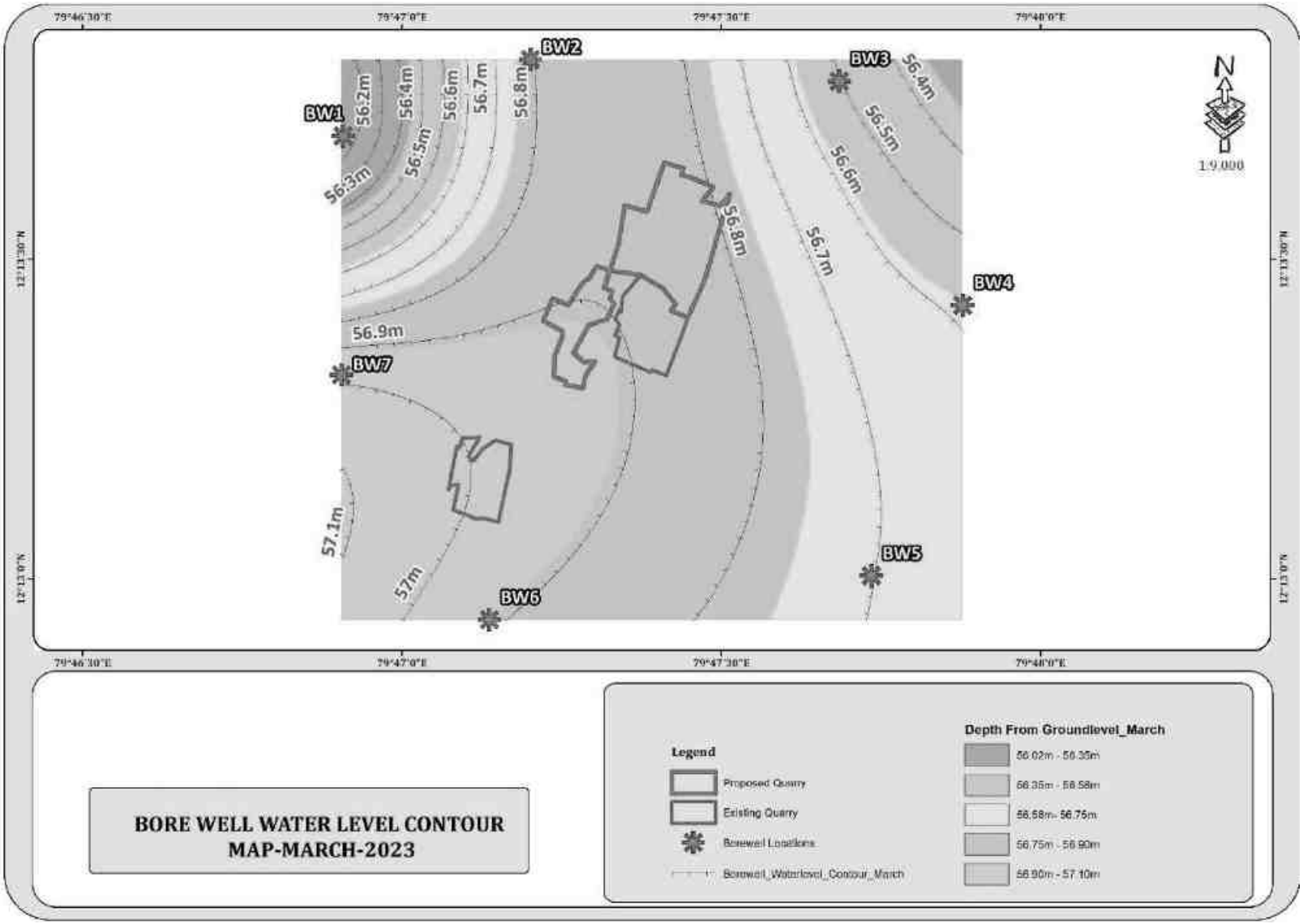


FIGURE 3.10: BOREWELL CONTOUR MAP – APRIL 2023

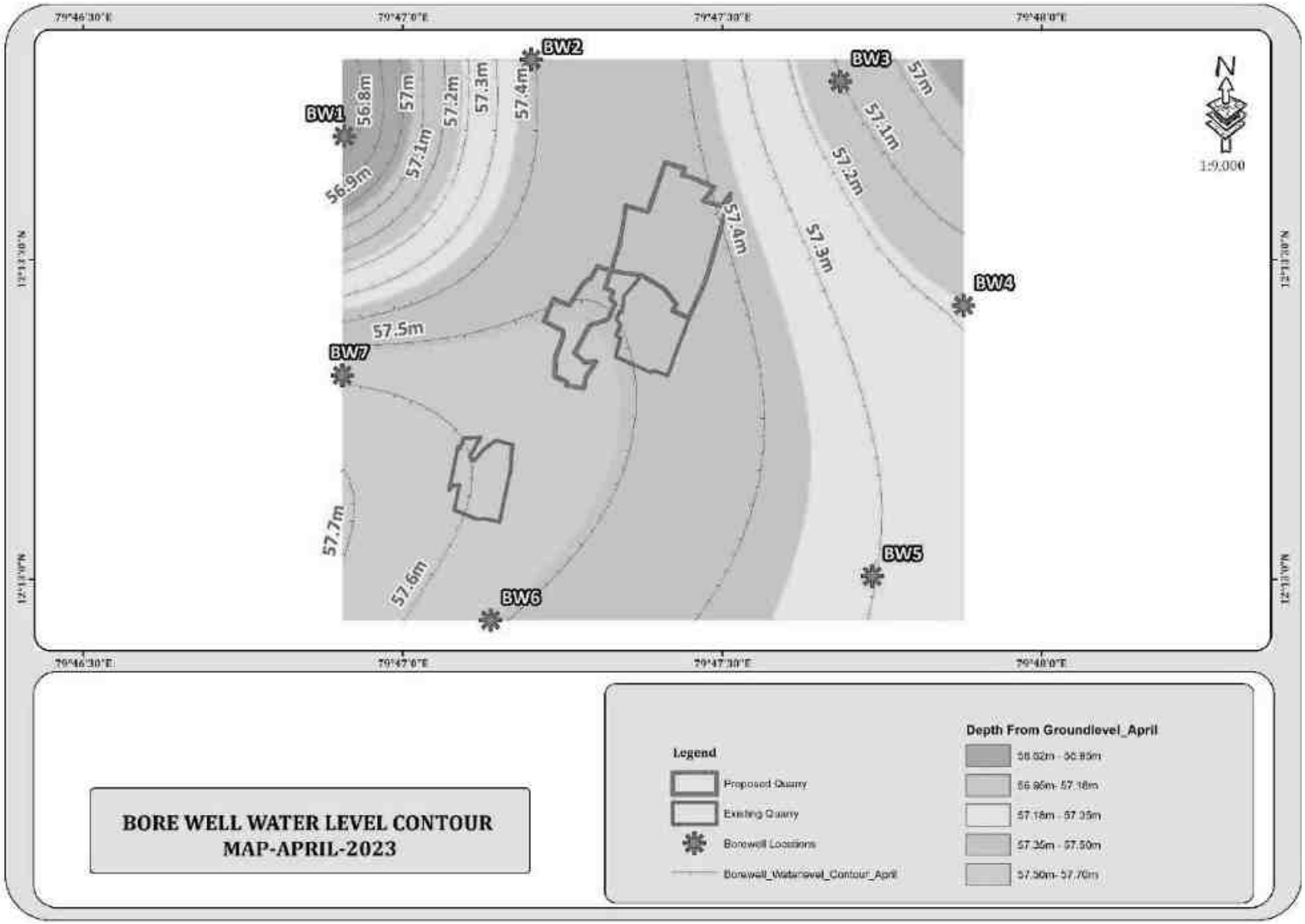


FIGURE 3.11: BOREWELL CONTOUR MAP – MAY 2023

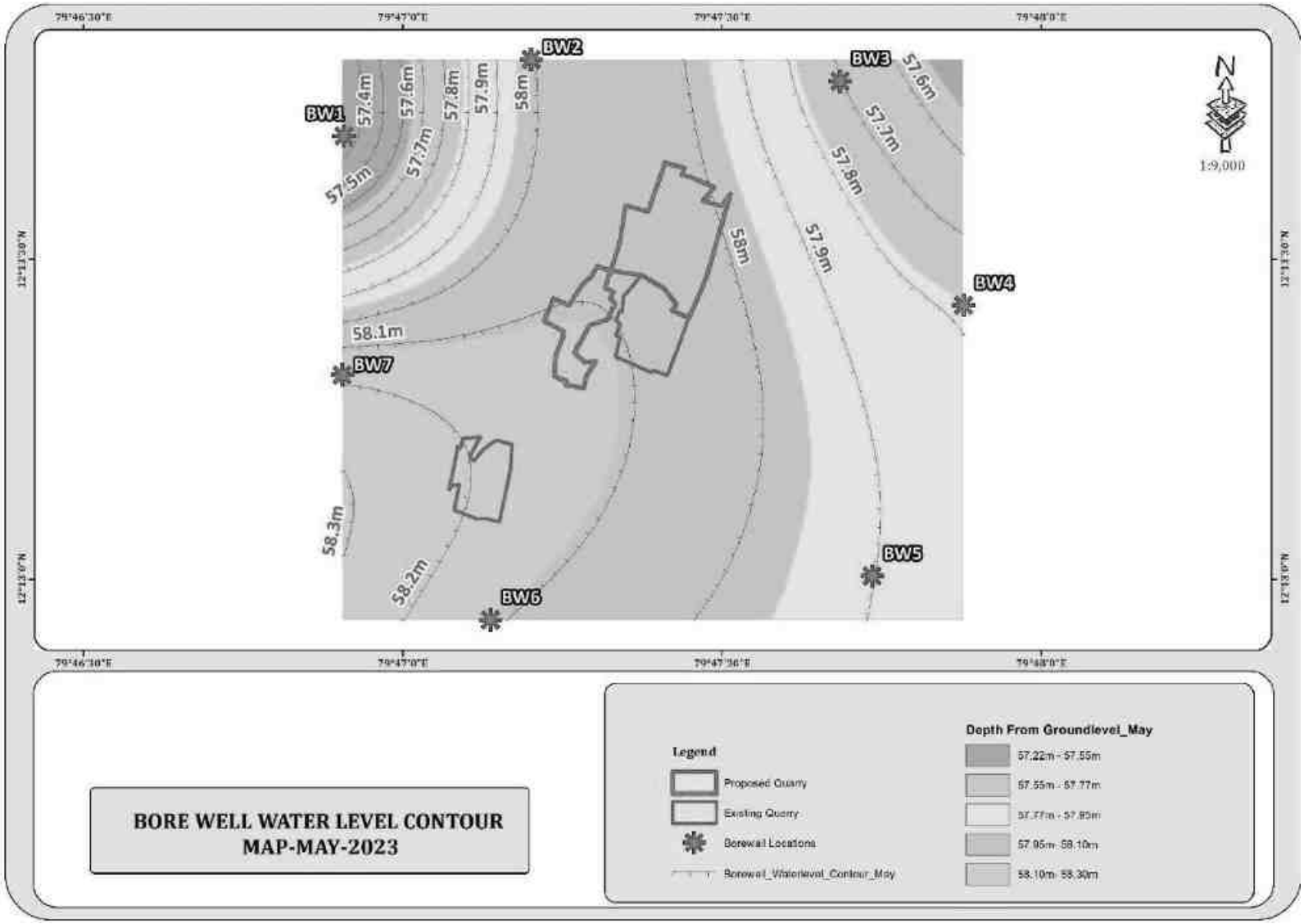


FIGURE 3.12: DRAINAGE MAP AROUND 10 KM RADIUS FROM PROJECT SITE

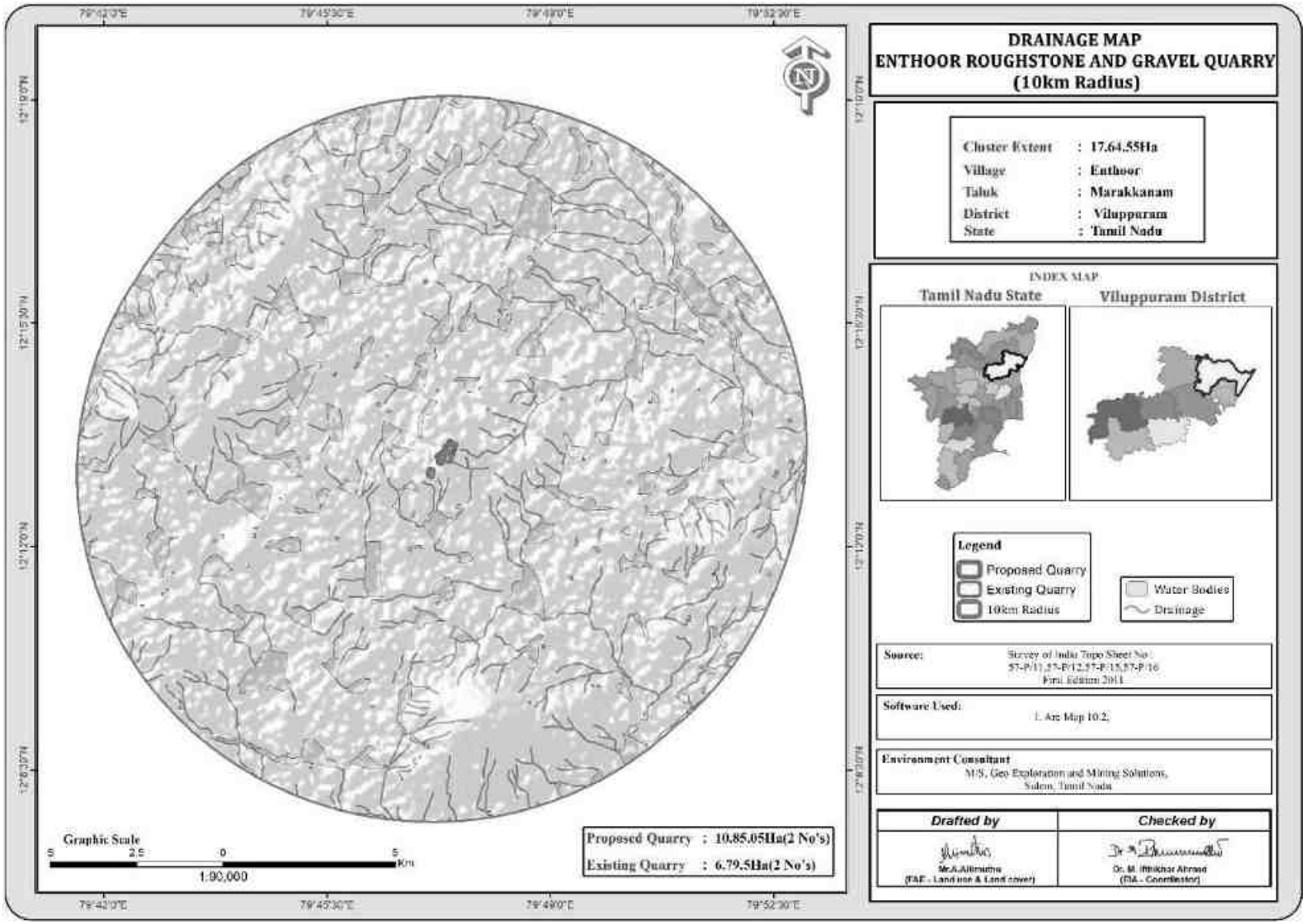
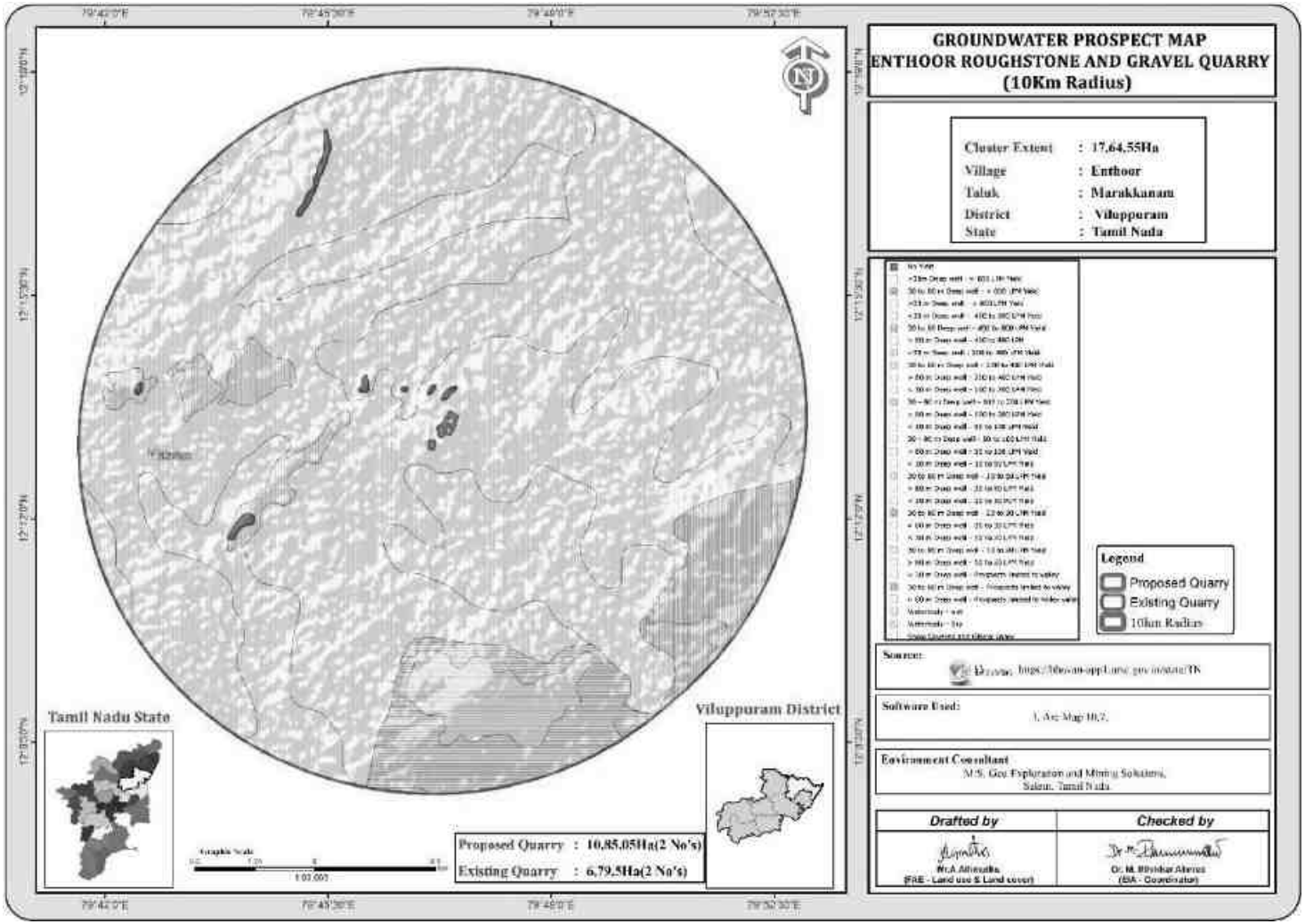


FIGURE 3.13: GROUND WATER PROSPECT MAP



3.2.5.1 Methodology and Data Acquisition

Electric Resistivity Method is well established for delineating lateral as well vertical discontinuities in the resistive structure of the Earth's subsurface. The present study makes use of vertical electric sounding (VES) to delineate the Vertical Resistivity structure at depth. Schlumberger electrode set up was employed for making sounding measurements. Since it is least influenced by lateral in homogeneities and is capable of providing higher depth of investigation. This is four electrodes collinear set up where in the outer electrodes send current into the ground and the inner electrodes measure the potential difference.

The present study utilizes maximum current electrode separation AB/2. The data from this survey are commonly arranged and contoured in the farm of Pseudo-section that gives an approximate of the subsurface resistivity. This technique is used for the inversion of Schlumberger VES data to predict the layer parameter namely layer resistivity and Geo electric layer thickness. The main goal of the present study is to search the vertical in homogeneities that is consistent with the measured data.

For a Schlumberger among the Apparent resistivity can be calculated as follows.

$$\rho_a = \frac{G\Delta V}{I}$$

ΔV = potential difference between receiving electrodes

G = Geometric Factor.

Rocks show wide variation in resistivity ranging from 10-8 more than 10+14 ohmmeter. On a broad classification, one can group the rocks falling in the range of 10-8 to 1 ohmmeter as good conductors. 1 to 106 ohmmeter as intermediate conductors and 106 to 1012 ohmmeter as more as poor conductor. The resistivity of rocks and subsurface lithology, which is mostly dependent on its porosity and the pore fluid resistivity is defined by Archie's Law,

$$\rho_r = F\rho_w = a\,\emptyset^m\rho_w$$

ρr = Resistivity of Rocks

ρw = Resistivity of water in pores of rock

F = Formation Factor

Ø = Fractional pore volume

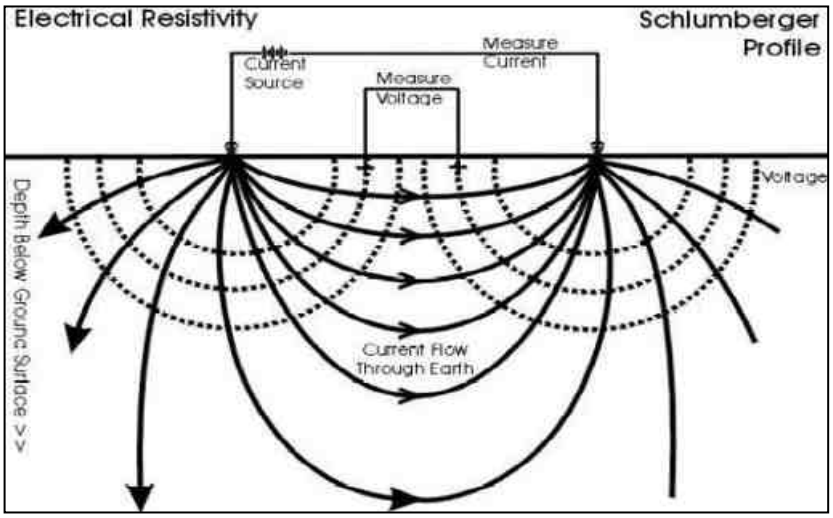
A = Constants with values ranging from 0.5 to 2.5

3.2.5.2 Survey Layout

The layout for a resistivity survey depends on the choice of the current and potential electrode arrangement, which is called electrode array. Here the present study is considered with Schlumberger array. In which the distance may be used for current electrode separation while potential electrode separation is kept on third to one fifth of the same. One interesting aspect in VES is the principle of reciprocity, which permits interchange of the potential and current electrode without any effect on the measured apparent resistivity.

The field equipment deployed for the study is in a deep resistivity meter with a model of SSR – MP – AT. This Signal stacking Resistivity meter is a high-quality data acquisition system incorporating several innovation features for Earth resistivity. In the presence of random earth Noises, the signal to nose ration can be enhanced by √N where N is the number of stacked readings. This SSR meter in which running averages of measurements [1, (1+2)/2, (1+2+3)/3 … (1+2...+16/16)] up to the chosen stacks are displayed and the final average is stored automatically, in memory utilizing the principles of stacking to achieve the benefit of high signals to noise ratio. Based on these above significations the signal stacking resistivity meter was used for (VES) Vertical Electric Resistivity Sounding.

RESISTIVITY SURVEY PROFILE



Measurements of ground Resistivity is essentially done by sending a current through two electrodes called current electrodes (C_1& C_2) and measuring the resulting potential by two other electrodes called potential electrode (P_1& P_2). The amount of current required to be sent into the ground depends on the contact resistance at the current electrode, the ground resistivity and the depth of interest.

3.2.5.3 Data Presentation

It was inferred that the low resistance encountered at the depth between **65-68m**. The maximum depth proposed out of proposed projects is **45m BGL**. Hence there is no possibilities of water table intersection during the entire mine life period besides it is also inferred topographically that there are no major water bodies intersecting the project area.

3.2.5.4 Geophysical Data Interpretation

The geophysical data was obtained to study the lateral variations, vertical in homogeneities in the sub – surface with respect to the availability of groundwater. From the interpreted data, it has inferred that the area has moderate groundwater potential in the investigated area. This small quarrying operation will not have any significant impact on the natural water bodies.

3.3 AIR ENVIRONMENT

The existing ambient air quality of the area is important for evaluating the impact of mining activities on the ambient air quality.

The baseline studies on air environment include identification of specific air pollution parameters and their existing levels in ambient air. The ambient air quality with respect to the study zone of 10 km radius around the cluster forms the baseline information. The sources of air pollution in the region are mostly due to vehicular traffic, dust arising from unpaved village road and domestic & agricultural activities. The prime objective of the baseline air quality study was to establish the existing ambient air quality of the study area. These will also be useful for assessing the conformity to standards of the ambient air quality during the operation of proposed projects in cluster.

This section describes the identification of sampling locations, methodology adopted during the monitoring period and sampling frequency.

3.3.1 Meteorology & Climate

Meteorology is the key to understand the Air quality. The essential relationship between meteorological condition and atmospheric dispersion involves the wind in the broadest sense. Wind fluctuations over a very wide range of time, accomplish dispersion and strongly influence other processes associated with them.

A temporary meteorological station was installed at project site by covering cluster quarries. The station was installed at a height of 3 m above the ground level in such a way that there are no obstructions facilitating flow of wind, wind speed, wind direction, humidity and temperature are recorded on hourly basis.

Climate –

- The climate here is tropical. In winter, there is much less rainfall in Villupuram than in summer. This climate is considered to be Aw according to the Köppen-Geiger climate classification. The average annual temperature is 28.0 °C | 82.4 °F in Villupuram. The annual rainfall is 1040 mm | 40.9 inch.
- Because Villupuram is located near the equator, the summers are not easy to define. The most opportune time to visit are January, February, March, December.
- The driest month is February, with 11 mm | 0.4 inch of rainfall. With an average of 208 mm | 8.2 inch, the most precipitation falls in October.
- The warmest month of the year is May, with an average temperature of 31.9 °C | 89.4 °F. January has the lowest average temperature of the year. It is 24.0 °C | 75.2 °F.

Source: https://en.climate-data.org/asia/india/tamil-nadu/villupuram-34141/

Rainfall –

TABLE 3.13: RAINFALL DATA

Actual Rainfall in mm					Normal Rainfall in mm
2017	2018	2019	2020	2021	
1066.99	727.5	906.3	1137.7	1935.2	985

Source: https://www.twadboard.tn.gov.in/content/villupuram

TABLE 3.14: METEOROLOGICAL DATA RECORDED AT SITE

S.No	Parameters		Mar – 2023	Apr – 2023	May – 2023
1	Temperature (^{0}C)	Max	28.98	30.9	31.44
		Min	26.36	28.57	28.20
		Avg	27.67	29.73	29.82
2	Relative Humidity (%)	Avg	74.03	72.19	79.03
3	Wind Speed (m/s)	Max	5.64	5.45	7.01
		Min	3.32	2.57	2.38
		Avg	4.48	4.01	4.69
4	Cloud Cover (OKTAS)		0-8	0-8	0-8
5	Wind Direction		ENE,SSE	SSE,ESE	SSW,SW

Source: On-site monitoring/sampling by EHS 360 Lab Private Limited Laboratories in association with GEMS

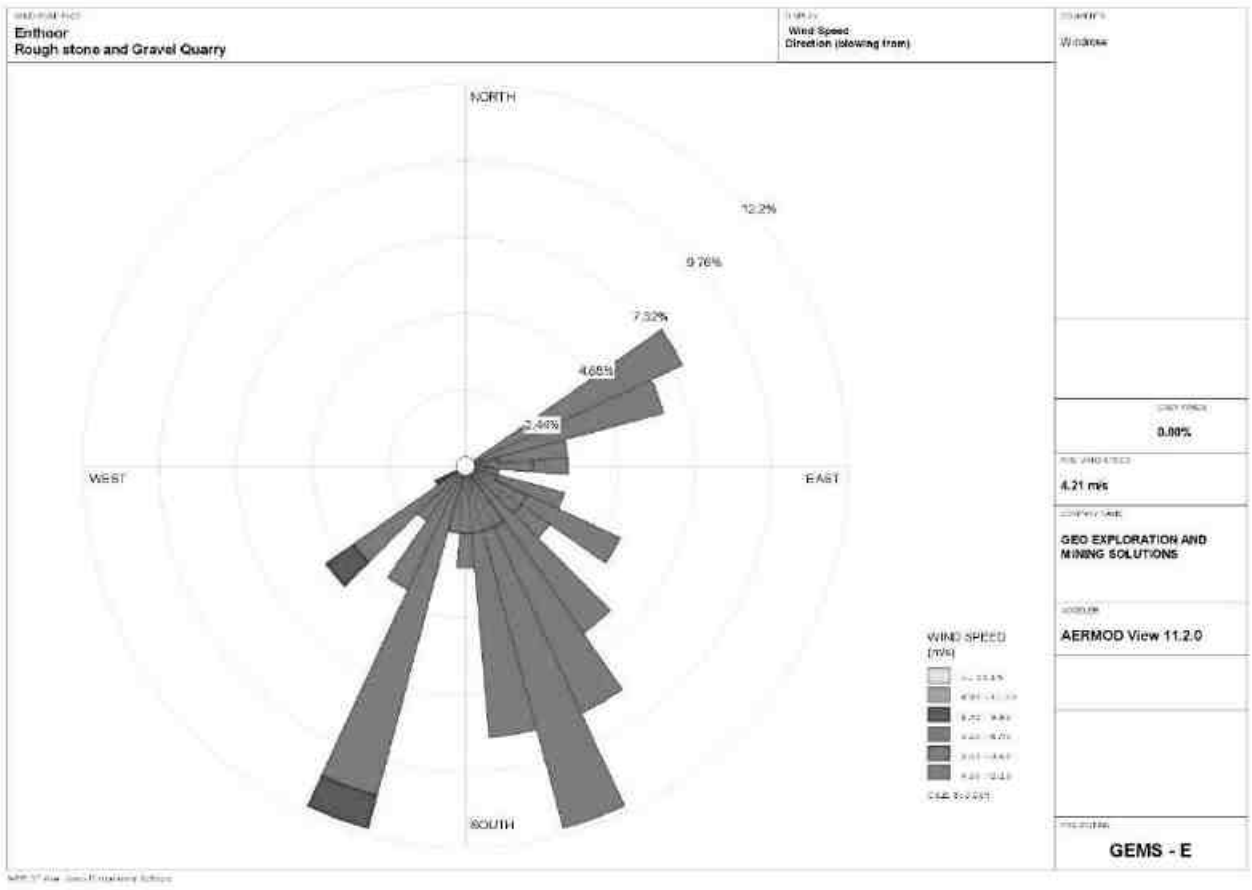
Correlation between Secondary and Primary Data

The meteorological data collected at the site is almost similar to that of secondary data collected from IMD Chennai_Agro. A comparison of site data generated during the three months with that of IMD, Chennai_Agro reveals the following:

- The average maximum and minimum temperatures of IMD, Chennai_Agro showed a higher in respect of on-site data i.e. in Enthoor village.
- The relative humidity levels were lesser at site as compared to IMD, Chennai_Agro.
- The wind speed and direction at site shows similar trend that of IMD, Chennai_Agro.

Wind rose diagram of the study site is depicted in Figure. 3.14. Predominant downwind direction of the area during study season is North-East to South West.

FIGURE 3.14: WINDROSE DIAGRAM



Source: Wind Rose plot view, Lake Environmental Software

In the abstract of collected data wind rose were drawn on presented in figure No.3.14 during the monitoring period in the study area

- Predominant winds were from NW – SE.
- Wind velocity readings were recorded between 8.80 to 11.10 m/s
- Calm conditions prevail of about 0.00 % of the monitoring period
- Temperature readings ranging from 26.36 to 31.44 °C
- Relative humidity ranging from 72.19 to 79.03 %
- The monitoring was carried out continuously for three months.

3.3.2 Methodology and Objective

The prime objective of the ambient air quality study is to assess the existing air quality of study area and its conformity to NAAQS. The observed sources of air pollution in the study area are industrial, traffic and domestic activities. The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality monitoring network considering the followings:

- Meteorological condition on synoptic scale;
- Topography of the study area;
- Representatives of regional background air quality for obtaining baseline status;
- Location of residential areas representing different activities;
- Accessibility and power availability; etc

3.3.3 Sampling and Analytical Techniques

TABLE 3.15: METHODOLOGY AND INSTRUMENT USED FOR AAQ ANALYSIS

Parameter	Method	Instrument
PM2.5	Gravimetric Method Beta attenuation Method	Fine Particulate Sampler Make – Thermo Environmental Instruments – TEI 121
PM10	Gravimetric Method Beta attenuation Method	Respirable Dust Sampler Make –Thermo Environmental Instruments – TEI 108
SO2	IS-5182 Part II (Improved West & Gaeke method)	Respirable Dust Sampler with gaseous attachment
NOx	IS-5182 Part II (Jacob & Hochheiser modifiedmethod)	Respirable Dust Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Source: Sampling Methodology followed by EHS 360 Lab Privated Limited & CPCB Notification

TABLE 3.16: NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl.No.	Pollutant	Time Weighted Average	Concentration in ambient air	
			Industrial, Residential, Rural & other areas	Ecologically Sensitive area (Notified by Central Govt.)
1	Sulphur Dioxide (µg/m3)	Annual Avg.* 24 hours**	50.0 80.0	20.0 80.0
2	Nitrogen Dioxide (µg/m3)	Annual Avg. 24 hours	40.0 80.0	30.0 80.0
3	Particulate matter (size less than 10µm) PM10 (µg/m3)	Annual Avg. 24 hours	60.0 100.0	60.0 100.0
4	Particulate matter (size less than 2.5 µm PM2.5 (µg/m3)	Annual Avg. 24 hours	40.0 60.0	40.0 60.0

Source: NAAQS CPCB Notification No. B-29016/20/90/PCI-I Dated: 18th Nov 2009

*Annual Arithmetic mean of minimum 104 measurements in a year taken twice a Week 24 hourly at uniform interval,

** 24 hourly / 8 hourly or 1 hourly monitored value as applicable shall be complied with 98 % of the time in a year. However, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

3.3.4 Frequency & Parameters for Sampling

Ambient air quality monitoring has been carried out with a frequency of two samples per week at Seven (7) locations, adopting a continuous 24 hourly (3 shift of 8-hour) schedule for the period March 2023 to May 2023. The baseline data of ambient air has been generated for PM_{10}, $PM_{2.5}$, Sulphur Dioxide (SO_2) & Nitrogen Dioxide (NO_2) Monitoring has been carried out as per the CPCB, MoEF guidelines and notifications.

It was ensured that the equipment was placed preferably at a height of at least 3 ± 0.5m above the ground level at each monitoring station, for negating the effects of wind-blown ground dust. The equipment was placed at open space free from trees and vegetation which otherwise act as a sink of pollutants resulting in lower levels in monitoring results.

3.3.5 Ambient Air Quality Monitoring Stations

Eight (8) monitoring stations were set up in the study area as depicted in Figure 3.15 for assessment of the existing ambient air quality. Details of the sampling locations are as per given below.

TABLE 3.17: AMBIENT AIR QUALITY (AAQ) MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	AAQ1	Core Zone	Project Area	12°13'20.40"N 79°47'15.20"E
2	AAQ2	Core Zone	Project Area	12°13'32.90"N 79°47'28.95"E
3	AAQ3	Budderi	2.3km NW	12°14'14.59"N 79°46'14.27"E
4	AAQ4	Vadanerkunam	3.2km NE	12°14'17.49"N 79°49'7.37"E
5	AAQ5	Brammadesam	2.6km SW	12°11'55.89"N 79°46'44.09"E
6	AAQ6	Arungunam	4.3km SW	12°12'53.65"N 79°44'52.20"E
7	AAQ7	Akshipakkam	3.5km North	12°15'32.99"N 79°47'32.19"E
8	AAQ8	Alanguppam	3.4km SE	12°12'0.14"N 79°48'37.05"E

Source: On-site monitoring/sampling by EHS 360 Lab Private Limited Laboratories in association with GEMS

FIGURE 3.15: AMBIENT AIR QUALITY LOCATIONS AROUND 10 KM RADIUS

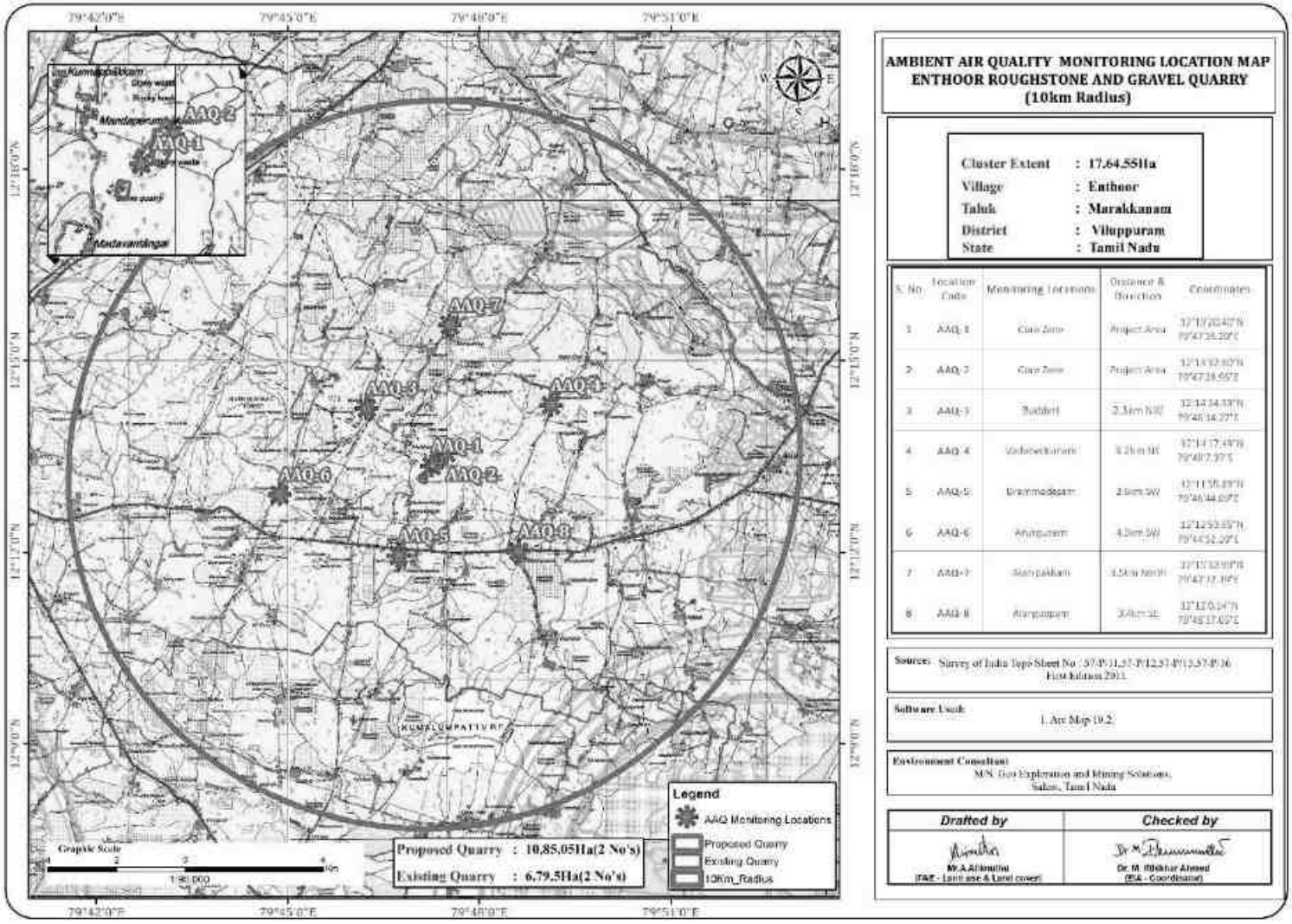


TABLE 3.18: AMBIENT AIR QUALITY DATA LOCATION AAQ1

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
02.03.2023	7:00-7:00	55.3	43.2	20.3	5.2	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.03.2023	7:15-7:15	56.2	42.1	22.1	6.3	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.03.2023	7:00-7:00	58.2	44.5	23.4	7.4	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2023	7:15-7:15	60.3	40.6	21.0	8.2	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.03.2023	7:00-7:00	56.3	41.1	22.3	5.3	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2023	7:15-7:15	57.4	42.2	23.4	6.0	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.03.2023	7:00-7:00	58.2	40.3	21.3	7.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2023	7:15-7:15	60.0	43.4	22.0	8.0	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2023	7:00-7:00	58.0	39.8	23.4	6.4	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2023	7:15-7:15	57.3	44.1	21.0	7.3	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.04.2023	7:00-7:00	55.2	42.4	23.5	8.2	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.04.2023	7:15-7:15	56.4	41.6	21.3	6.1	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.04.2023	7:00-7:00	55.2	42.6	22.3	7.3	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2023	7:15-7:15	56.8	43.1	23.6	8.4	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.04.2023	7:00-7:00	57.2	40.1	22.1	5.0	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.04.2023	7:15-7:15	58.6	42.7	22.7	6.8	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.04.2023	7:00-7:00	55.3	43.4	23.6	7.2	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2023	7:00-7:00	56.2	42.0	21.0	6.0	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.05.2023	7:15-7:15	57.2	44.7	22.3	7.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2023	7:00-7:00	58.2	42.6	23.0	8.2	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.05.2023	7:15-7:15	59.3	43.8	21.6	5.3	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2023	7:00-7:00	60.1	44.2	22.3	6.4	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.05.2023	7:15-7:15	58.2	40.9	23.5	7 .8	24.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2023	7:00-7:00	55.3	41.7	21.0	7.0	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.05.2023	7:15-7:15	57.3	43.4	23.6	6.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2023	7:00-7:00	58.2	40.9	22.4	5.4	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1:0); **Pb**: BDL (DL:0:1); **Ni**: BDL (DL:1:0); **As**: BDL (DL:1:0); **C_6H_6**: BDL (DL:1:0); **BaP**: BDL (DL:0:1)
Remarks: The values observed for the pollutants given above are within the CPCB standards:

TABLE 3.19: AMBIENT AIR QUALITY DATA LOCATION -AAQ2

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
02.03.2023	7:00-7:00	62.3	45.3	23.2	6.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.03.2023	7:15-7:15	61.0	41.3	21.2	7.1	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.03.2023	7:00-7:00	63.4	42.6	20.2	5.0	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2023	7:15-7:15	64.0	40.2	21.8	6.3	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.03.2023	7:00-7:00	65.5	44.2	23.6	7.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2023	7:15-7:15	63.0	39.3	22.4	8.0	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.03.2023	7:00-7:00	62.2	40.2	20.3	7.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2023	7:15-7:15	64.0	43.0	23.5	6.4	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2023	7:00-7:00	63.0	44.0	21.6	7.2	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2023	7:15-7:15	64.2	40.3	20.5	5.3	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.04.2023	7:00-7:00	65.3	43.2	21.0	6.2	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.04.2023	7:15-7:15	62.1	44.3	22.3	7.1	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.04.2023	7:00-7:00	64.2	39.4	21.6	6.0	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2023	7:15-7:15	65.5	43.1	23.5	7.3	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.04.2023	7:00-7:00	63.0	42.0	22.0	8.2	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.04.2023	7:15-7:15	64.0	44.0	23.5	6.4	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.04.2023	7:00-7:00	65.2	40.3	23.0	7.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2023	7:00-7:00	63.7	41.2	22.4	8.2	21.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.05.2023	7:15-7:15	65.0	45.0	21.6	5.0	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2023	7:00-7:00	64.0	43.8	23.5	6.3	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.05.2023	7:15-7:15	63.2	42.2	20.3	7.2	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2023	7:00-7:00	60.2	44.0	21.3	6.0	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.05.2023	7:15-7:15	61.2	43.0	20.5	5.4	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2023	7:00-7:00	62.4	39.8	21.6	6.0	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.05.2023	7:15-7:15	63.5	44.2	20.6	7.2	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2023	7:00-7:00	62.0	42.5	21.8	6.3	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)
Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.20: AMBIENT AIR QUALITY DATA LOCATION AAQ3

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
02.03.2023	7:00-7:00	c	39.0	23.1	5.2	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.03.2023	7:15-7:15	62.3	39.8	20.1	6.3	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.03.2023	7:00-7:00	63.1	38.2	21.3	7.0	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2023	7:15-7:15	64.2	37.6	22.3	6.0	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.03.2023	7:00-7:00	62.0	36.5	23.0	5.3	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2023	7:15-7:15	63.1	39.5	21.5	7.2	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.03.2023	7:00-7:00	64.2	39.4	23.6	6.0	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2023	7:15-7:15	63.2	38.2	20.1	7.2	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2023	7:00-7:00	64.5	38.7	21.3	5.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2023	7:15-7:15	62.0	36.5	23.0	6.0	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.04.2023	7:00-7:00	63.1	35.4	22.4	7.1	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.04.2023	7:15-7:15	62.4	34.5	23.5	5.5	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.04.2023	7:00-7:00	63.5	36.2	21.0	6.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2023	7:15-7:15	64.2	35.8	20.3	7.2	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.04.2023	7:00-7:00	62.0	34.9	22.5	5.3	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.04.2023	7:15-7:15	63.5	36.1	23.6	6.2	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.04.2023	7:00-7:00	64.1	39.1	21.5	7.1	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2023	7:00-7:00	63.0	38.3	20.3	5.5	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.05.2023	7:15-7:15	62.1	37.4	21.5	6.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2023	7:00-7:00	63.0	35.6	23.5	7.2	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.05.2023	7:15-7:15	64.2	36.4	20.3	5.0	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2023	7:00-7:00	63.0	38.5	21.5	6.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.05.2023	7:15-7:15	62.4	39.3	22.6	7.2	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2023	7:00-7:00	64.0	37.6	23.4	6.4	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.05.2023	7:15-7:15	63.0	39.4	20.5	7.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2023	7:00-7:00	62.1	38.3	23.4	5.0	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)
Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.21: AMBIENT AIR QUALITY DATA LOCATION AAQ4

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
02.03.2023	7:00-7:00	64.2	36.1	20.3	5.3	23.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.03.2023	7:15-7:15	65.3	35.3	22.1	6.2	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.03.2023	7:00-7:00	66.5	34.6	23.2	5.0	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2023	7:15-7:15	67.2	36.7	20.5	6.0	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.03.2023	7:00-7:00	65.0	35.8	23.4	5.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2023	7:15-7:15	66.3	34.9	21.6	6.0	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.03.2023	7:00-7:00	64.1	34.3	22.0	5.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2023	7:15-7:15	65.0	35.2	23.4	6.4	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2023	7:00-7:00	66.2	36.2	21.0	5.0	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2023	7:15-7:15	67.0	37.4	22.3	6.2	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.04.2023	7:00-7:00	64.3	38.5	23.5	5.3	26.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.04.2023	7:15-7:15	65.2	39.6	22.0	6.4	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.04.2023	7:00-7:00	66.0	36.9	23.4	5.2	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2023	7:15-7:15	67.5	38.7	20.3	6.3	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.04.2023	7:00-7:00	64.2	36.9	21.5	6.0	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.04.2023	7:15-7:15	65.3	39.2	22.4	5.4	25.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.04.2023	7:00-7:00	66.1	38.7	23.5	6.8	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2023	7:00-7:00	67.2	37.4	23.0	5.3	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.05.2023	7:15-7:15	65.0	36.8	21.5	6.1	21.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2023	7:00-7:00	66.0	35.9	22.0	5.0	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.05.2023	7:15-7:15	67.4	36.0	23.5	6.3	22.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2023	7:00-7:00	65.2	39.8	20.3	5.4	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.05.2023	7:15-7:15	66.3	38.4	21.5	6.8	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2023	7:00-7:00	67.0	39.3	23.4	5.0	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.05.2023	7:15-7:15	65.8	37.6	22.0	6.2	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2023	7:00-7:00	64.2	36.0	23.5	5.3	22.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)
Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.22: AMBIENT AIR QUALITY DATA LOCATION AAQ5

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
02.03.2023	7:00-7:00	63.2	44.2	20.2	6.2	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.03.2023	7:15-7:15	64.2	43.1	21.3	7.3	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.03.2023	7:00-7:00	65.2	45.0	22.3	8.2	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2023	7:15-7:15	66.3	46.3	23.1	6.0	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.03.2023	7:00-7:00	63.0	47.2	21.0	7.3	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2023	7:15-7:15	65.2	43.2	22.3	8.1	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.03.2023	7:00-7:00	64.3	44.0	23.4	7.3	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2023	7:15-7:15	62.3	45.2	22.3	6.8	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2023	7:00-7:00	63.2	46.3	23.1	7.2	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2023	7:15-7:15	64.5	47.2	24.2	8.3	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.04.2023	7:00-7:00	65.5	43.2	25.3	6.0	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.04.2023	7:15-7:15	63.3	45.2	20.1	7.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.04.2023	7:00-7:00	62.0	46.3	22.3	8.3	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2023	7:15-7:15	64.0	47.1	23.4	6.4	25.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.04.2023	7:00-7:00	65.3	43.2	20.0	8.0	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.04.2023	7:15-7:15	63.2	45.0	21.3	7.3	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.04.2023	7:00-7:00	64.0	46.3	22.3	6.5	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2023	7:00-7:00	65.0	47.2	23.4	7.5	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.05.2023	7:15-7:15	63.8	45.2	23.5	8.0	21.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2023	7:00-7:00	64.2	46.3	21.0	7.3	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.05.2023	7:15-7:15	63.8	47.1	23.0	8.2	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2023	7:00-7:00	65.0	43.2	20.0	6.1	22.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.05.2023	7:15-7:15	66.2	44.2	21.3	7.2	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2023	7:00-7:00	64.3	45.3	22.3	8.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.05.2023	7:15-7:15	62.1	46.2	23.0	6.0	22.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2023	7:00-7:00	63.2	47.2	21.0	7.3	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)
Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.23: AMBIENT AIR QUALITY DATA LOCATION AAQ6

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
02.03.2023	7:00-7:00	62.3	44.0	22.3	6.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.03.2023	7:15-7:15	63.1	45.2	23.1	7.3	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.03.2023	7:00-7:00	64.2	46.3	20.2	6.1	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2023	7:15-7:15	65.5	45.0	21.3	7.0	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.03.2023	7:00-7:00	60.2	46.2	22.3	6.5	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2023	7:15-7:15	63.5	44.3	22.1	7.3	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.03.2023	7:00-7:00	64.5	45.2	23.4	6.4	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2023	7:15-7:15	62.0	46.1	22.0	7.2	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2023	7:00-7:00	63.4	45.2	23.4	6.8	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2023	7:15-7:15	65.5	46.3	21.5	7.3	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.04.2023	7:00-7:00	64.2	45.5	20.5	6.5	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.04.2023	7:15-7:15	65.3	43.2	22.3	7.4	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.04.2023	7:00-7:00	60.2	45.6	21.6	6.8	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2023	7:15-7:15	61.3	44.2	23.8	7.3	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.04.2023	7:00-7:00	62.3	44.0	22.4	7.6	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.04.2023	7:15-7:15	65.4	43.2	23.5	6.0	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.04.2023	7:00-7:00	63.2	45.6	21.0	7.3	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2023	7:00-7:00	65.0	46.1	22.3	6.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.05.2023	7:15-7:15	64.0	43.2	22.0	7.2	24.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2023	7:00-7:00	62.3	45.5	23.5	6.0	25..0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.05.2023	7:15-7:15	61.0	46.2	23.0	7.1	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2023	7:00-7:00	62.3	43.1	21.6	6.6	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.05.2023	7:15-7:15	63.1	45.2	22.3	7.2	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2023	7:00-7:00	64.5	46.8	22.5	6.4	23.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.05.2023	7:15-7:15	65.5	45.0	23.4	7.3	24.2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2023	7:00-7:00	62.3	43.2	22.1	6.4	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.24: AMBIENT AIR QUALITY DATA LOCATION AAQ7

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	ng/m^3	ng/m^3	$\mu g/m^3$	ng/m^3
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
02.03.2023	7:00-7:00	63.0	44.2	22.3	6.2	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.03.2023	7:15-7:15	64.2	45.3	23.1	7.3	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.03.2023	7:00-7:00	65.2	46.2	20.2	6.4	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2023	7:15-7:15	67.2	47.2	21.3	7.3	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.03.2023	7:00-7:00	66.0	45.0	23.2	6.0	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2023	7:15-7:15	65.3	46.2	22.0	7.2	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.03.2023	7:00-7:00	64.2	47.2	23.4	6.4	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2023	7:15-7:15	62.1	45.2	22.2	7.3	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2023	7:00-7:00	63.1	46.3	23.3	6.8	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2023	7:15-7:15	65.5	47.2	21.0	7.2	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.04.2023	7:00-7:00	62.0	45.0	23.5	6.0	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.04.2023	7:15-7:15	63.0	46.3	21.5	7.1	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.04.2023	7:00-7:00	64.2	47.2	23.6	6.3	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2023	7:15-7:15	66.0	45.3	22.8	7.4	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.04.2023	7:00-7:00	67.3	46.0	23.7	6.2	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.04.2023	7:15-7:15	65.7	47.2	21.6	7.0	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.04.2023	7:00-7:00	67.0	45.0	23.5	6.0	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2023	7:00-7:00	63.2	46.3	22.1	7.0	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.05.2023	7:15-7:15	65.5	47.2	21.3	6.2	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2023	7:00-7:00	64.2	45.1	22.6	7.3	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.05.2023	7:15-7:15	63.0	46.3	22.3	6.4	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2023	7:00-7:00	65.3	47.0	21.4	7.6	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.05.2023	7:15-7:15	62.0	45.0	22.0	7.3	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2023	7:00-7:00	64.3	43.2	23.5	6.2	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.05.2023	7:15-7:15	65.0	46.7	21.4	7.8	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2023	7:00-7:00	64.2	45.5	23.0	6.1	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.24A: AMBIENT AIR QUALITY DATA LOCATION AAQ8

Ambient Air Monitoring Details		Particulate Pollutant			Gaseous Pollutant					Metals Pollutant			Organic Pollutant	
Parameters		SPM	PM_{10}	$PM_{2.5}$	SO_2	NO_2	NH_3	O_3	CO	Pb	Ni	As	C_6H_6	BaP
NAAQ Norms		200	100	60	80	80	400	180	4	1	20	6	5	1
Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³	µg/m³	ng/m³	ng/m³	µg/m³	ng/m³
Date	Period.hrs	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
02.03.2023	7:00-7:00	63.4	42.3	22.1	6.2	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
03.03.2023	7:15-7:15	63.6	44.1	23.0	7.3	25.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
09.03.2023	7:00-7:00	65.3	45.2	21.0	8.5	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10.03.2023	7:15-7:15	65.4	46.3	20.3	5.0	24.3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.03.2023	7:00-7:00	67.0	43.2	21.4	6.3	25.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.03.2023	7:15-7:15	65.3	42.5	20.0	7.1	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.03.2023	7:00-7:00	64.2	44.1	23.1	8.2	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24.03.2023	7:15-7:15	62.1	45.3	22.4	6.0	23.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30.03.2023	7:00-7:00	63.1	46.2	22.5	7.3	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31.03.2023	7:15-7:15	65.5	40.5	23.1	5.0	21.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
06.04.2023	7:00-7:00	62.0	45.3	21.0	7.3	24.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
07.04.2023	7:15-7:15	63.0	39.7	23.5	8.2	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
13.04.2023	7:00-7:00	64.2	42.0	23.4	6.0	23.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.04.2023	7:15-7:15	66.0	45.3	21.6	7.3	24.5	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20.04.2023	7:00-7:00	67.3	39.3	23.0	8.1	25.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
21.04.2023	7:15-7:15	65.7	46.3	21.0	5.3	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27.04.2023	7:00-7:00	67.0	45.5	21.3	6.2	25.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28.04.2023	7:00-7:00	63.2	46.3	22.3	7.3	24.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
04.05.2023	7:15-7:15	65.5	42.1	23.5	8.8	25.8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
05.05.2023	7:00-7:00	64.2	43.0	22.6	5.4	23.6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
11.05.2023	7:15-7:15	63.0	42.6	21.0	6.3	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
12.05.2023	7:00-7:00	65.3	42.0	23.5	7.1	25.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18.05.2023	7:15-7:15	62.0	46.5	20.3	8.2	25.0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19.05.2023	7:00-7:00	65.6	43.7	22.5	5.0	23.4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25.05.2023	7:15-7:15	66.4	44.6	23.6	6.3	24.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26.05.2023	7:00-7:00	63.2	40.8	21.8	7.0	23.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: BDL: Below Detection Limit ;**DL**: Detection Limit ; **NH_3**: BDL (DL:20); **O_3**: BDL (DL:20); **CO**: BDL (DL:1.0); **Pb**: BDL (DL:0.1); **Ni**: BDL (DL:1.0); **As**: BDL (DL:1.0); **C_6H_6**: BDL (DL:1.0); **BaP**: BDL (DL:0.1)

Remarks: The values observed for the pollutants given above are within the CPCB standards.

TABLE 3.25: SUMMARY OF AAQ – 1 to AAQ – 8

Particulate matter PM_{-10}			
Station ID	**Max**	**Min**	**Mean**
AAQ-1	44.7	39.8	42.4
AAQ-2	45.3	39.3	42.4
AAQ-3	39.8	34.5	37.5
AAQ-4	39.8	34.3	37.0
AAQ-5	47.2	43.1	45.4
AAQ-6	46.8	43.1	45.0
AAQ-7	47.2	42.3	45.9
AAQ-8	47.2	39.3	43.6
Particulate matter $PM_{-2.5}$			
Station ID	**Max**	**Min**	**Mean**
AAQ-1	23.6	20.3	22.3
AAQ-2	23.6	20.2	21.9
AAQ-3	23.6	20.1	222.0
AAQ-4	23.5	20.3	22.2
AAQ-5	25.3	20.0	22.2
AAQ-6	23.8	20.2	22.3
AAQ-7	23.7	20.2	22.4
AAQ-8	23.6	20.0	22.1
Sulphur Di-oxide as SO_2			
Station ID	**Max**	**Min**	**Mean**
AAQ-1	8.4	5.0	6.7
AAQ-2	8.2	5.0	6.6
AAQ-3	7.3	5.0	6.2
AAQ-4	6.8	5.0	5.8
AAQ-5	8.3	6.0	7.2
AAQ-6	7.6	6.0	6.8
AAQ-7	7.8	6.0	6.8
AAQ-8	8.8	5.0	6.8
Oxide of Nitrogen as NO_2			
Station ID	**Max**	**Min**	**Mean**
AAQ-1	25.6	23.0	24.1
AAQ-2	25.6	21.0	24.0
AAQ-3	25.6	23.0	24.3
AAQ-4	26.3	21.0	24.1
AAQ-5	25.5	21.0	23.8
AAQ-6	25.8	23.0	24.3
AAQ-7	25.6	23.0	24.3
AAQ-8	25.9	21.4	24.2

TABLE 3.26: ABSTRACT OF AMBIENT AIR QUALITY DATA

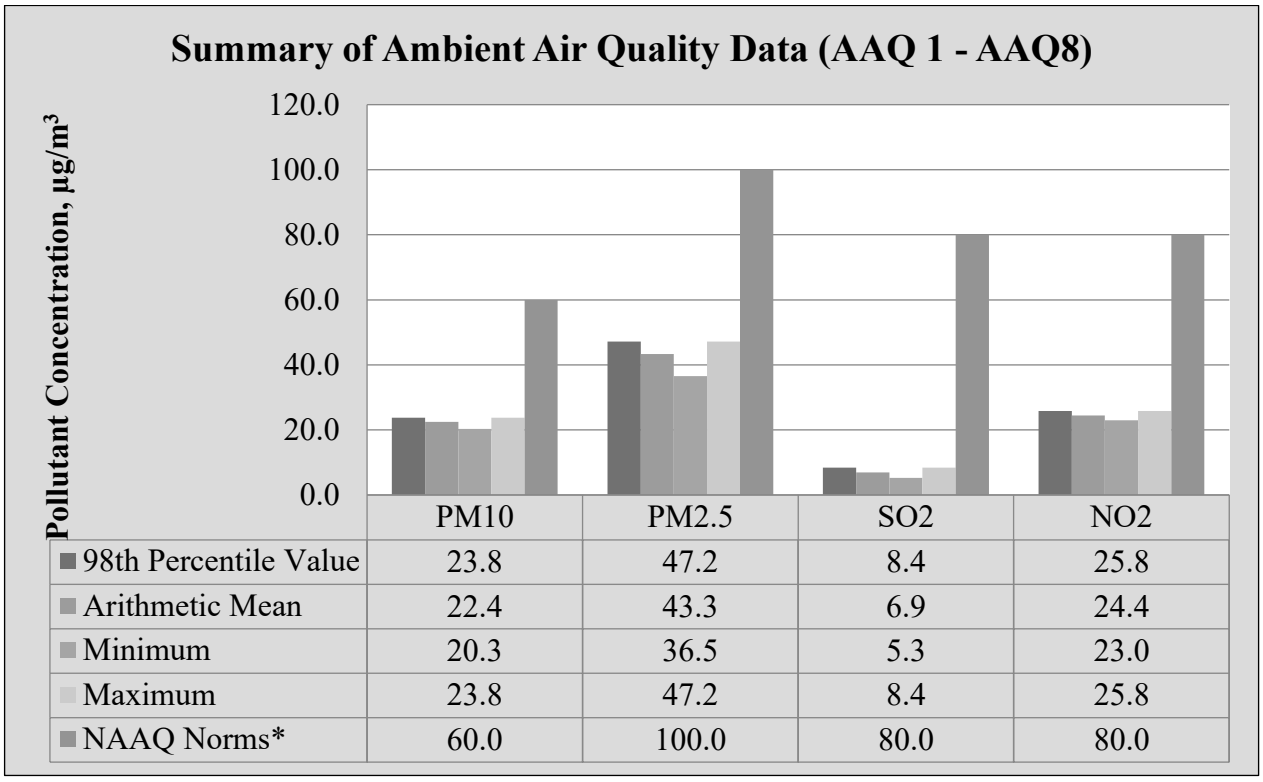
Parameter	PM2.5	PM10	SO_2	NO_2
No. of Observations	260	260	260	260
10^{th} Percentile Value	20.3	36.5	5.3	23.0
20^{th} Percentile Value	21.0	38.7	6.0	23.1
30^{th} Percentile Value	21.5	40.3	6.2	23.5
40^{th} Percentile Value	22.0	42.4	6.3	23.8
50^{th} Percentile Value	22.3	43.2	6.4	24.1
60^{th} Percentile Value	22.4	44.2	7.1	24.5
70^{th} Percentile Value	23.0	45.2	7.2	24.6
80^{th} Percentile Value	23.4	45.6	7.3	25.2
90^{th} Percentile Value	23.5	46.3	8.0	25.5
95^{th} Percentile Value	23.6	47.2	8.2	25.6
98^{th} Percentile Value	23.8	47.2	8.4	25.8
Arithmetic Mean	22.4	43.3	6.9	24.4
Geometric Mean	22.4	43.2	6.9	24.4
Standard Deviation	1.2	3.6	1.0	1.0
Minimum	20.3	36.5	5.3	23.0
Maximum	23.8	47.2	8.4	25.8
NAAQ Norms*	**100.0**	**60.0**	**80.0**	**80.0**
% Values exceeding Norms*	0.0	0.0	0.0	0.0

Legend: $PM_{2.5}$-Particulate Matter size less than 2.5 µm; PM_{10}-Respirable Particulate Matter size less than 10 µm; SO_2-Sulphur dioxide; NO_x-Oxides of Nitrogen; CO-Carbon monoxide; O_3-Ozone; NH_3-Ammonia;

Pb-Particulate Lead; As-Particulate Arsenic; Ni-Particulate Nickel; C_6H_6-Benzene &BaP- Benzo (a) pyrene in particulate phase levels were monitored below their respective detectable limits

* NAAQ Norms-National Ambient Air Quality Norms-Revised as per GSR 826(E) dated 16.11.2009 for Industrial, Residential, Rural and other Areas.

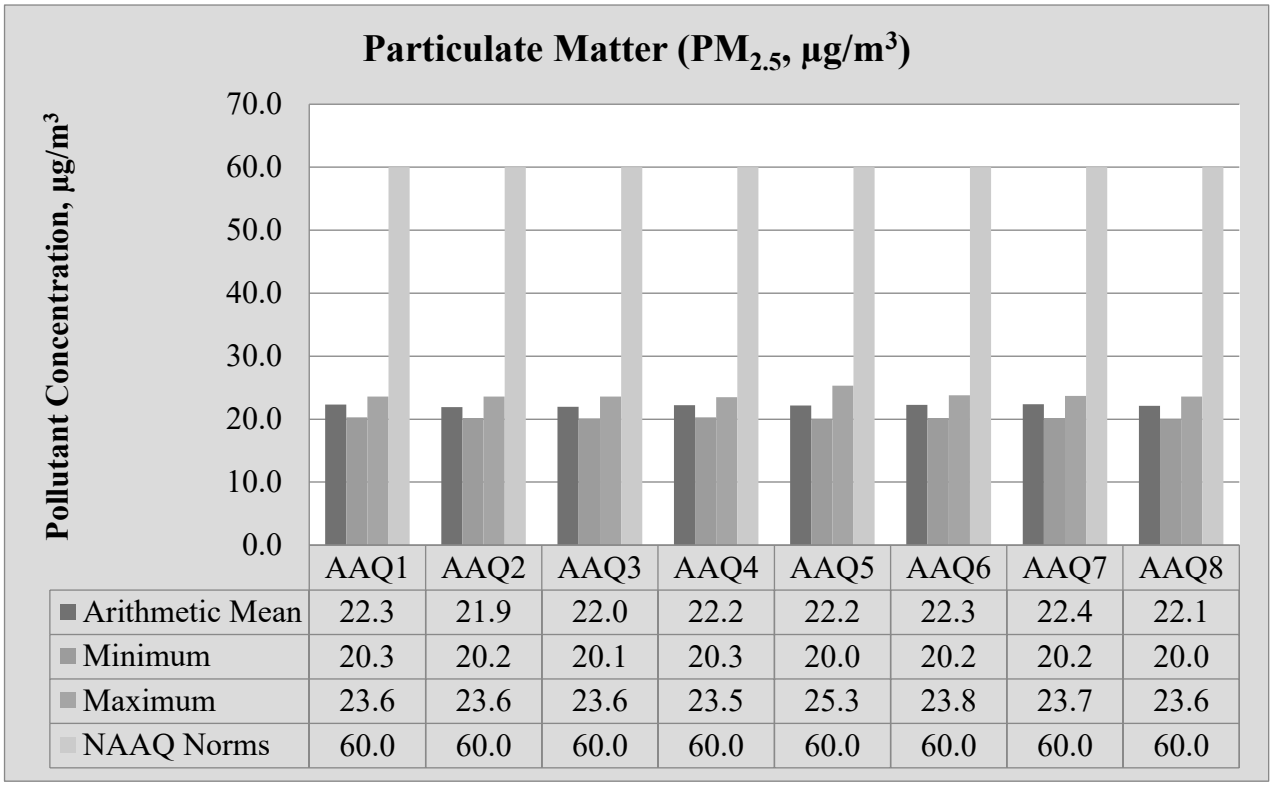
FIGURE 3.16: BAR DIAGRAM OF SUMMARY OF AAQ 1 – AAQ 8



	PM10	PM2.5	SO2	NO2
98th Percentile Value	23.8	47.2	8.4	25.8
Arithmetic Mean	22.4	43.3	6.9	24.4
Minimum	20.3	36.5	5.3	23.0
Maximum	23.8	47.2	8.4	25.8
NAAQ Norms*	60.0	100.0	80.0	80.0

Source: Table 3.17 to 3.27

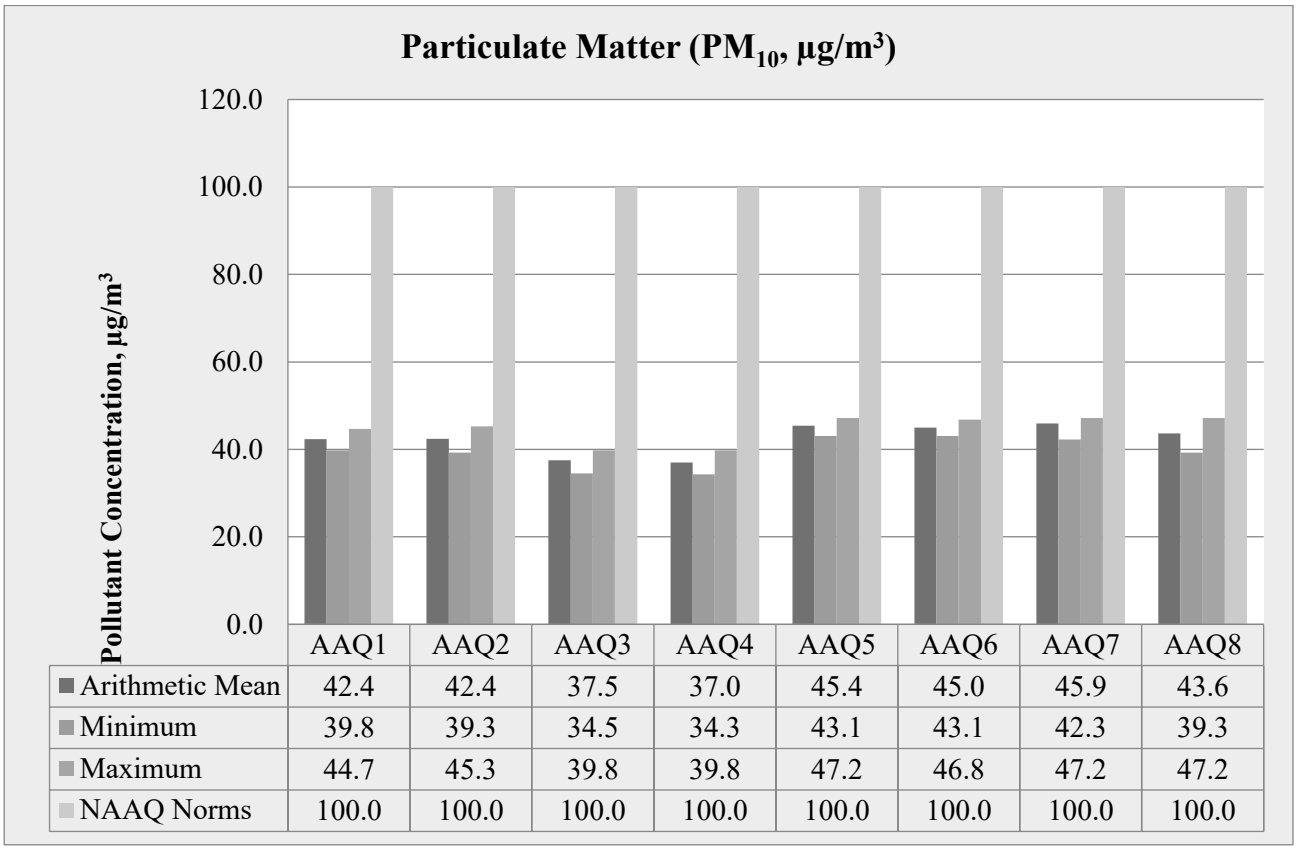
FIGURE 3.17: BAR DIAGRAM OF PARTICULATE MATTER $PM_{2.5}$



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	22.3	21.9	22.0	22.2	22.2	22.3	22.4	22.1
Minimum	20.3	20.2	20.1	20.3	20.0	20.2	20.2	20.0
Maximum	23.6	23.6	23.6	23.5	25.3	23.8	23.7	23.6
NAAQ Norms	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0

Source: Table 3.17 to 3.27

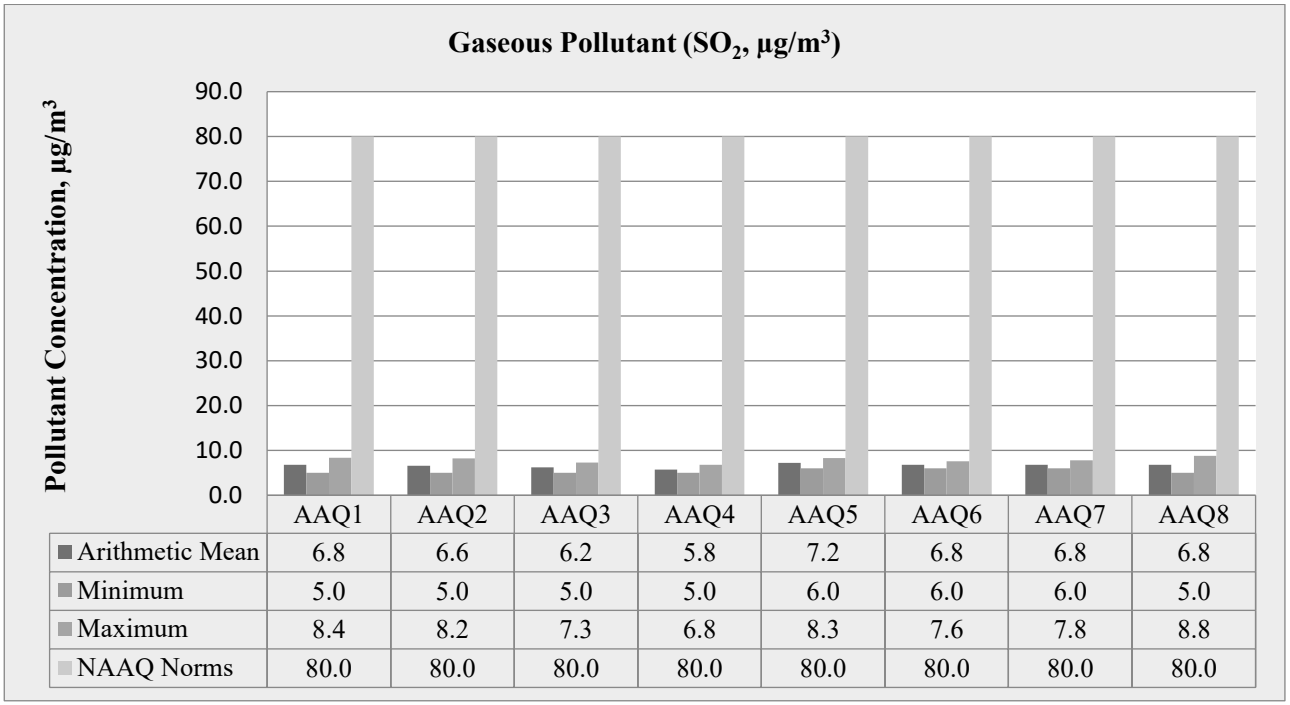
FIGURE 3.18: BAR DIAGRAM OF PARTICULATE MATTER PM_{10}



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	42.4	42.4	37.5	37.0	45.4	45.0	45.9	43.6
Minimum	39.8	39.3	34.5	34.3	43.1	43.1	42.3	39.3
Maximum	44.7	45.3	39.8	39.8	47.2	46.8	47.2	47.2
NAAQ Norms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Table 3.17 to 3.27

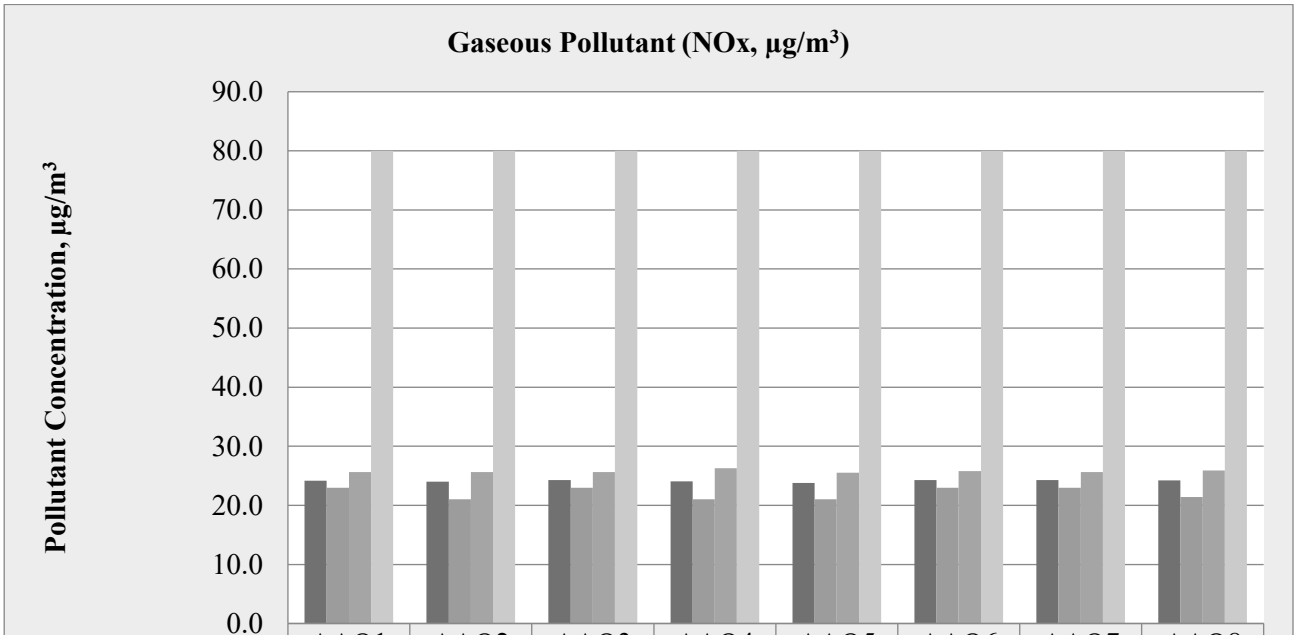
FIGURE 3.19: BAR DIAGRAM OF GASEOUS POLLUTANT SO_2



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	6.8	6.6	6.2	5.8	7.2	6.8	6.8	6.8
Minimum	5.0	5.0	5.0	5.0	6.0	6.0	6.0	5.0
Maximum	8.4	8.2	7.3	6.8	8.3	7.6	7.8	8.8
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

Source: Table 3.17 to 3.27

FIGURE 3.20: BAR DIAGRAM OF GASEOUS POLLUTANT NO_x



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	24.1	24.0	24.3	24.1	23.8	24.3	24.3	24.2
Minimum	23.0	21.0	23.0	21.0	21.0	23.0	23.0	21.4
Maximum	25.6	25.6	25.6	26.3	25.5	25.8	25.6	25.9
NAAQ Norms	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

Source: Table 3.17 to 3.27

3.3.6 Interpretations & Conclusion

As per monitoring data, PM_{10} ranges from 34.3 µg/m^3 to 47.2 µg/m^3, $PM_{2.5}$ data ranges from 20.0 µg/m^3 to25.3 µg/m^3, SO_2 ranges from 5.0µg/m^3 to 8.8 µg/m^3 and NO_2 data ranges from 21.0 µg/m^3 to 26.3 µg/m^3. The concentration levels of the above criteria pollutants were observed to be well within the limits of NAAQS prescribed by CPCB.

3.3.7 FUGITIVE DUST EMISSION –

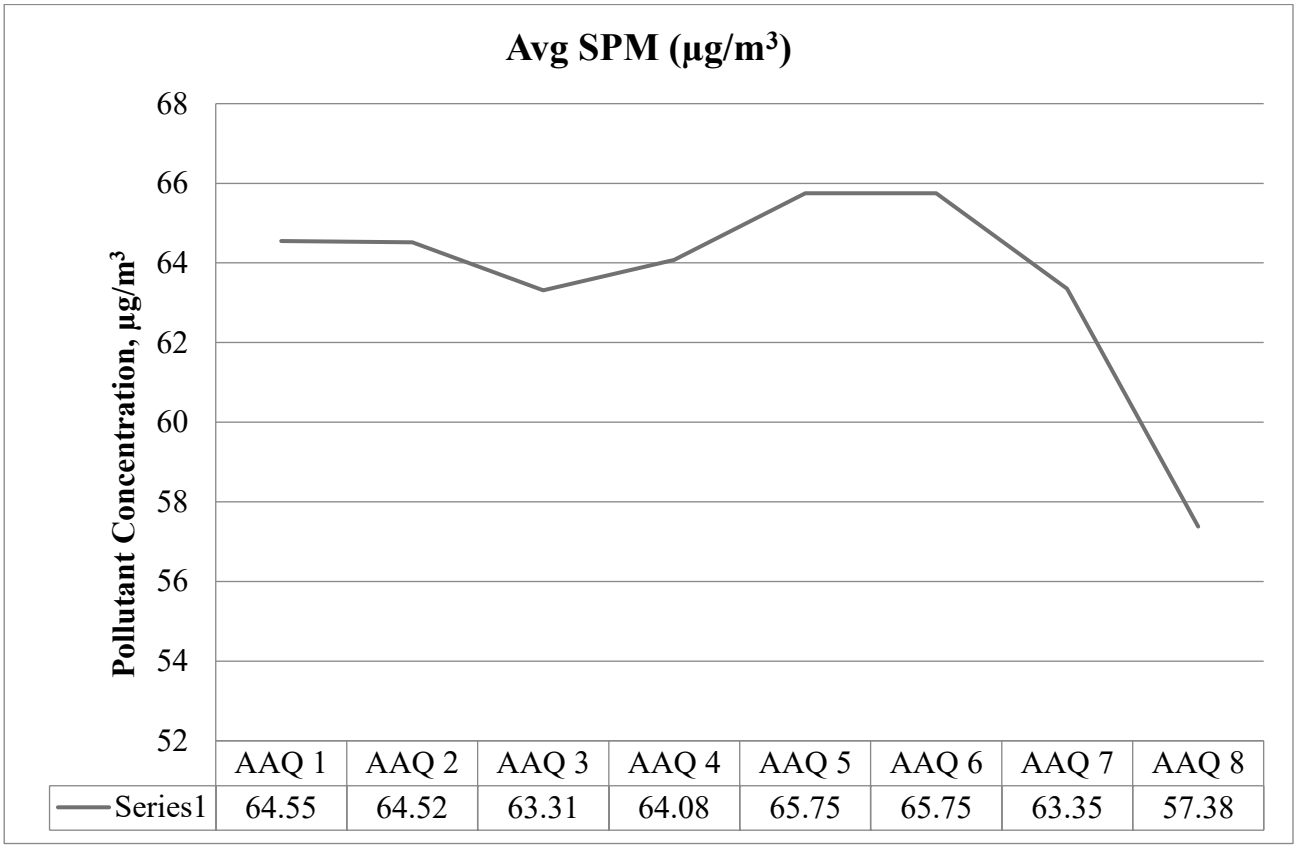
Fugitive dust was recorded at 8AAQ monitoring stations for 26 days average during the study period.

TABLE 3.27: AVERAGE FUGITIVE DUST SAMPLE VALUES

AAQ Locations	Avg SPM (µg/m^3)
AAQ 1	64.55
AAQ 2	64.52
AAQ 3	63.31
AAQ 4	64.08
AAQ 5	65.75
AAQ 6	65.75
AAQ7	63.35
AAQ8	57.38

Source: Onsite monitoring/ sampling by EHS 360 Lab Private Limited

FIGURE 3.21: LINE DIAGRAM OF AVERAGE SPM VALUES



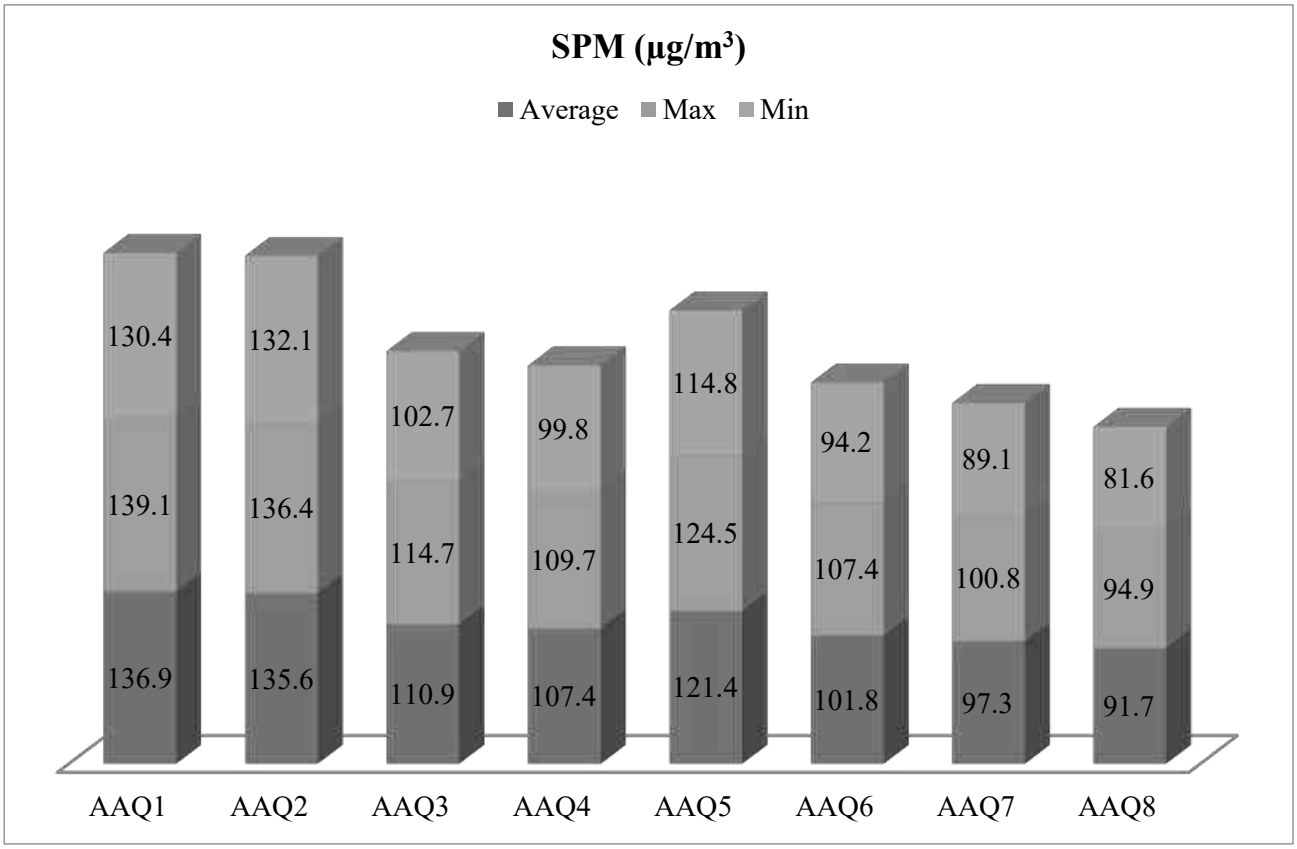
Source: Table 3.28

TABLE 3.28: FUGITIVE DUST SAMPLE VALUES IN µg/m^3

SPM	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
Arithmetic Mean	64.55	64.52	63.31	64.08	65.75	65.75	63.35	57.80
Minimum	63.4	63	62.3	63.2	64.2	64.2	62.3	55.3
Maximum	66.4	65	65.5	62.1	65.8	65.8	63.5	57.3
NAAQ Norms	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0

Source: Statistical analysis from Lab Data's

FIGURE 3.22: BAR DIAGRAM OF SPM VALUES



Source: Table 3.29

3.4 NOISE ENVIRONMENT

The vehicular movement on road and mining activities is the major sources of noise in study area, the environmental assessment of noise from the mining activity and vehicular traffic can be undertaken by taking into consideration various factors like potential damage to hearing, physiological responses, and annoyance and general community responses.

The main objective of noise monitoring in the study area is to establish the baseline noise level and assess the impact of the total noise expected to be generated during the project operations around the project site.

3.4.1 Identification of Sampling Locations

In order to assess the ambient noise levels within the study area, noise monitoring was carried out at Eight (8) locations. The noise level monitoring locations were carried out by covering commercial, residential, rural areas within the radius of 10km. A noise monitoring methodology was chosen such that it best suited the purpose and objectives of the study.

TABLE 3.29: DETAILS OF SURFACE NOISE MONITORING LOCATIONS

S. No	Location Code	Monitoring Locations	Distance & Direction	Coordinates
1	N1	Core Zone	Project Area	12°13'18.34"N 79°47'15.60"E
2	N2	Core Zone	Project Area	12°13'33.14"N 79°47'26.61"E
3	N3	Budderi	2.3km NW	12°14'14.60"N 79°46'14.03"E
4	N4	Vadanerkunam	3.2km NE	12°14'17.34"N 79°49'7.30"E
5	N5	Brammadesam	2.6km SW	12°11'56.20"N 79°46'44.08"E
6	N6	Arungunam	4.3km SW	12°12'53.85"N 79°44'52.12"E
7	N7	Akshipakkam	3.5km North	12°15'33.10"N 79°47'32.05"E
8	N8	Alanguppam	3.4km SE	12°11'59.98"N 79°48'37.01"E

Source: On-site monitoring/sampling by EHS 360 Lab Private Limited in association with GEMS

3.4.2 Method of Monitoring

Digital Sound Level Meter was used for the study. All reading was taken on the 'A-Weighting' frequency network, at a height of 1.5 meters from ground level. The sound level meter does not give a steady and consistent reading and it is quite difficult to assess the actual sound level over the entire monitoring period. To mitigate this shortcoming, the Continuous Equivalent Sound level, indicated by Leq, is used. Equivalent sound level, 'Leq', can be obtained from variable sound pressure level, 'L', over a time period by using following equation. The equivalent noise level is defined mathematically as,

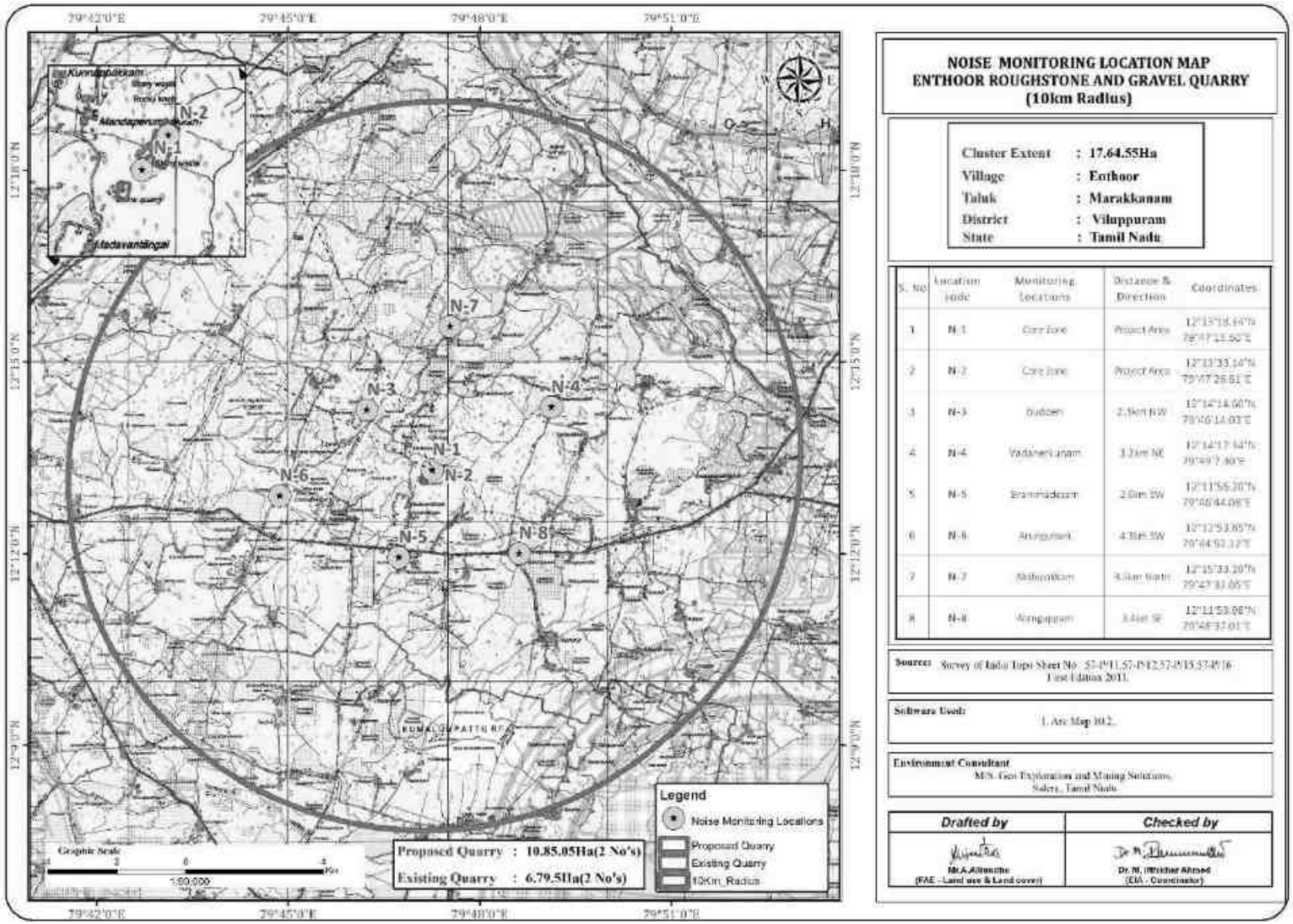
Leq = 10 Log L / T∑ (10Ln/10)

Where L = Sound pressure level at function of time dB (A)

T = Time interval of observation

Measured noise levels, displayed as a function of time, is useful for describing the acoustical climate of the community. Noise levels recorded at each station with a time interval of about 60 minutes are computed for equivalent noise levels. Equivalent noise level is a single number descriptor for describing time varying noise levels.

FIGURE 3.23: NOISE MONITORING STATIONS AROUND 10 KM RADIUS



3.4.3 Analysis of Ambient Noise Level in the Study Area

The Digital Sound pressure level has been measured by a sound level meter (Model: HTC SL-1352)

An analysis of the different Leq data obtained during the study period has been made. Variation was noted during the day-time as well as night-time. The results are presented in below Table 3.32.

Day time: 6:00 hours to 22.00 hours.

Night time: 22:00 hours to 6.00 hours.

TABLE 3.30: AMBIENT NOISE QUALITY RESULT

S. No	Locations	Noise level (dB (A) Leq)		Ambient Noise Standards
		Day Time	Night Time	
1	Core Zone	41.7	34.3	**Industrial Day Time- 75 dB (A) Night Time- 70 dB (A)**
2	Core Zone	40.7	35.1	
3	Budderi	39.1	34.6	**Residential Day Time– 55 dB (A) Night Time- 45 dB (A)**
4	Vadanerkunam	39.9	34.4	
5	Brammadesam	40.5	34.1	
6	Arungunam	40.8	35.8	
7	Akshipakkam	39.4	36.3	
8	Alanguppam	36.8	35.0	

Source: On-site monitoring/sampling by EHS 360 Lab Private Limited in association with GEMS

FIGURE 3.24: DAY TIME NOISE LEVELS IN CORE AND BUFFER ZONE

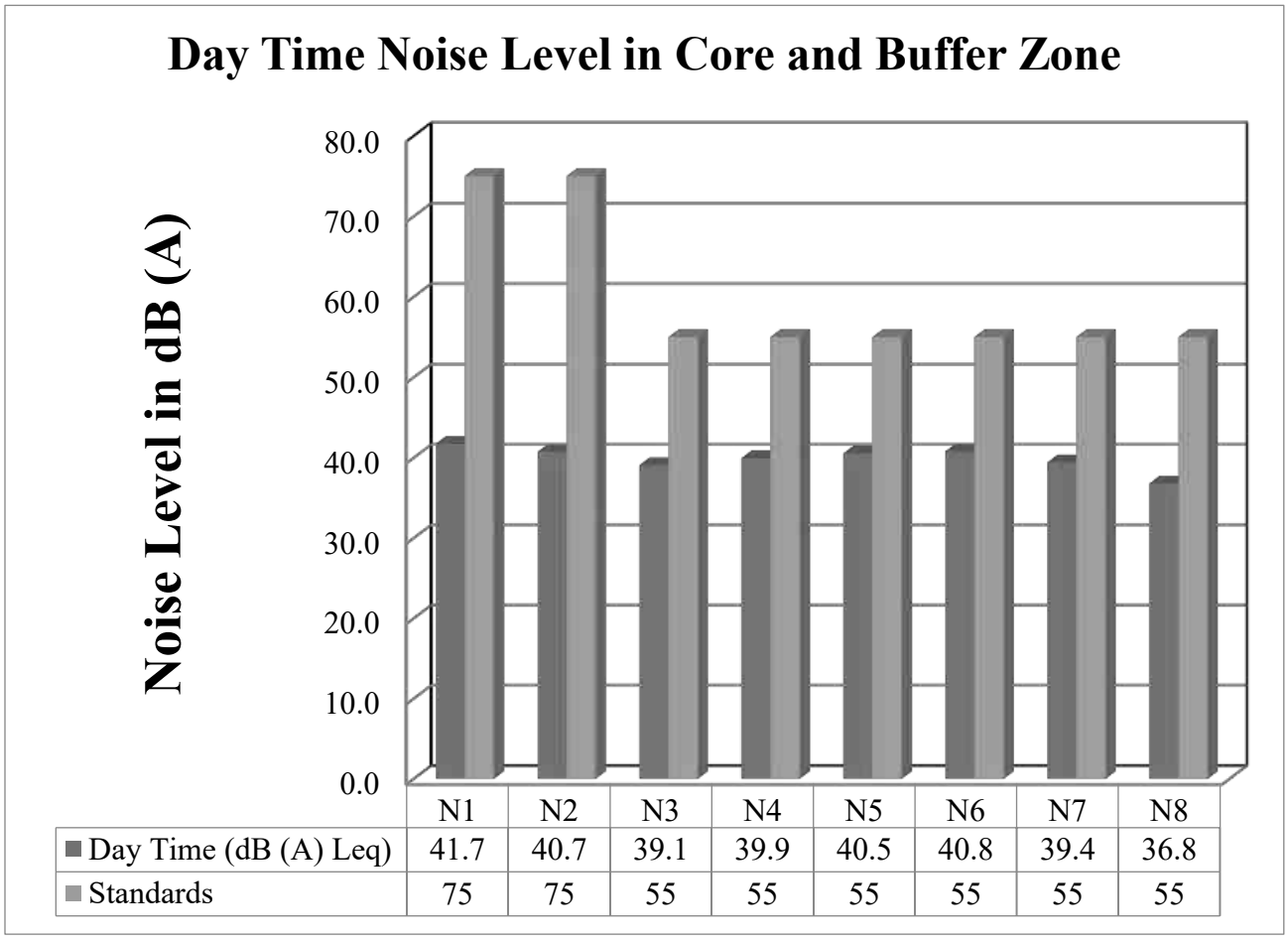
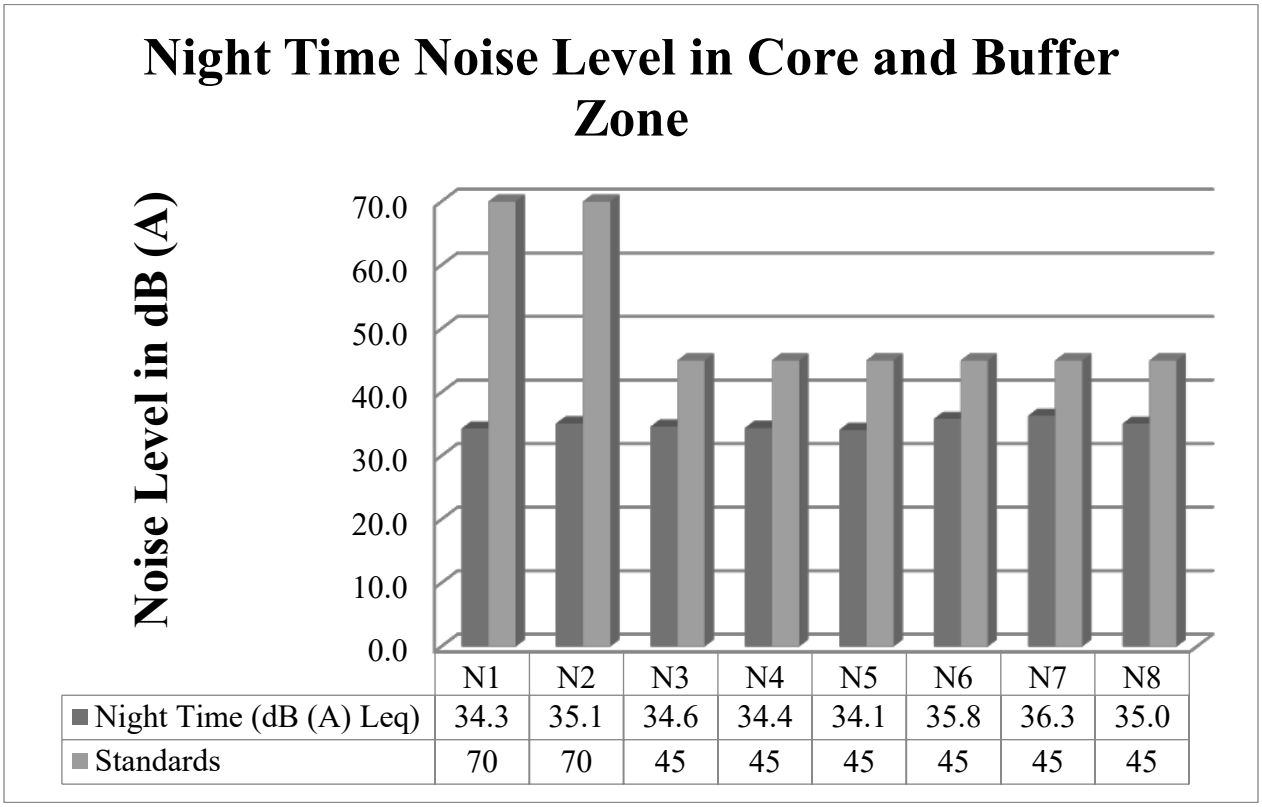


FIGURE 3.25: NIGHT TIME NOISE LEVELS IN CORE AND BUFFER ZONE



	N1	N2	N3	N4	N5	N6	N7	N8
Night Time (dB (A) Leq)	34.3	35.1	34.6	34.4	34.1	35.8	36.3	35.0
Standards	70	70	45	45	45	45	45	45

3.4.4 Interpretation & Conclusion:

Ambient noise levels were measured at 8 (Eight) locations around the proposed project area. Noise levels recorded in core zone during day time 40.7 dB (A) Leq to 41.7 dB (A) Leq and during night time were from 34.3 dB (A) Leq to 35.1 dB (A) Leq . Noise levels recorded in buffer zone during day time were from 36.8 to 40.8 dB (A) Leq and during night time were from 34.1 to 36.3 dB (A) Leq.

Thus, the noise level for Industrial and Residential area meets the requirements of CPCB.

3.5 ECOLOGICAL ENVIRONMENT

Ecology is a branch of science which dealing the relations and interactions between organisms and their environment. An ecological survey of the study area was conducted, particularly with reference to listing of species and assessment of the existing baseline ecological conditions in the study area. The main objective of biological study is to collect the baseline data regarding flora and fauna in the study area. Data has been collected through extensive survey of the area with reference to flora and fauna. Information is also collected from different sources i.e. government departments such as District Forest Office, Government of Tamil Nadu. The checklist of flora and fauna was prepared based on the onsite observations as well as forest department records.

3.5.1 Scope of Work

Scope of work for this study includes identification of ecologically sensitive receptors, based on literature survey, field investigations and their mitigation with conservation action plan. The study was carried out in the core as well as buffer zone of the Proposed Rough stone quarry. The study was carried out systematically and scientifically using primary and secondary data in order to bring out factual information on the ecological conditions of the mine site and 10 km radius study area.

The study involved assessment of general habitat type, vegetation pattern, preparation of inventory of flora and fauna of terrestrial ecosystem within 10 km radius from the boundary of all the Proposed Mine site. Biological

assessment of the site was done to identify ecologically sensitive areas and whether there are any rare, endangered, endemic or threatened (REET) species of flora & fauna in the core area as well its buffer zone to be impacted. The study also designed to suggest suitable mitigation measures, if necessary, for protection of wildlife habitats and conservation of REET species if any.

3.5.2 Objectives of Biological Studies

The present study was undertaken with the following objectives:

1. To study the likely impact of the proposed mining project on the local biodiversity and to suggest mitigation measure, if required, for vulnerable biota.
2. To assess the nature and distribution of vegetation (Terrestrial and Aquatic) in and around the mining activity.
3. Detail of flora and fauna, Endemic, Rare, Endangered and Threatened (RET Species) separately for core and buffer area based on such primary field survey and clearly indicating the Schedule of fauna present. In case of any schedule- I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished.
4. Devise management & conservation measures for biodiversity.

3.5.3 Methodology of Sampling

The present study was carried out in given steps

1. Field survey was conducted by visual encounter survey for flora present within the 10 km radius study area of all the proposed mine site.
2. After surveying the core and buffer areas, a detailed floral inventory has been compiled. List of all plants of the study area was prepared and their habitats were recorded.
3. Verification of Rare, Endangered and Threatened Flora species from IUCN Red Data Book.
4. Plants and Animals communities were noted.

Site selection criteria: Identification of vegetation in relation to the natural flora and crops was conducted through reconnaissance field surveys and onsite observations in core and buffer zone. The plant species identification was done based on the reference materials and also by examining the morphological characteristics and reproductive materials i.e. flowers, fruits and seeds. Land use pattern in relation to agriculture crop varieties were identified through physical verification of land and interaction with local villagers.

The faunal elements (animal species) of core and buffer zone were identified by direct sightings or indirect evidences viz. pug marks, skeletal remains, scats and droppings etc. (Jayson and Easa 2004). Standard binocular was used for the observations. The authenticity of faunal elements occurrence was confirmed by interaction with the local people. Avifauna identification was done with pictorial descriptions of published literature. Information pertaining to existence of any migratory corridors and paths were obtained from local inhabitants. The status of each faunal element was determined and the Wildlife schedule category was ascertained as per the IUCN-Red Data Book and Indian wildlife (Protection) Act, 1972.

Plot method is used in the floral documentation in the core and buffer zone. For trees (10x10-m), shrubs (5x5-m) and herbs (1x1-m) plots were taken. Birds and butterflies were mainly focused during faunal assessment, transect method was employed for birds and butterflies. Transect is a path along which one counts and records the occurrence of an individual for study. A straight-line walk covering desired distance, within a time span of one hour to 30 minutes was carried out in the proposed region. Bird species were recorded during the hours of peak activity. 0700 to 1100 Hrs and 1430 to 1730 Hrs (Bibby et al. 2000).

Direct observations and bird calls were used for bird documentation. Same transects were used for counting butterflies. Opportunistic observations were made for Amphibians, reptiles and ordinates. Presence of mammals was recorded by direct and indirect signs. All possible transects were taken for birds and butterflies. Birds and butterflies were classified into species level. Recorded bird species were identified to species level using standard books (Ali & Ripley 1987, Grimmett et al., 2016).

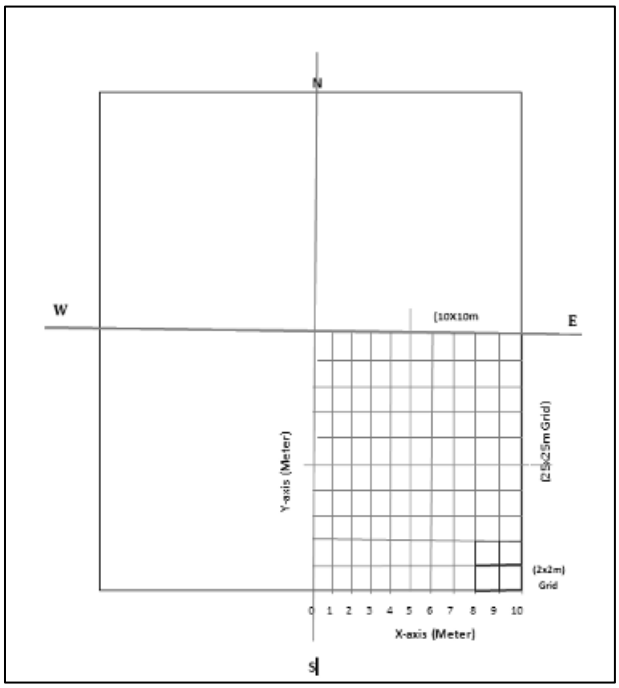
Phyto-sociological Survey method

Phyto-sociological parameters, viz., Abundance, Density, Frequency (%) were measured. A total of 10 quadrats were laid down randomly within core area and 40 quadrats were laid down within four quartiles randomly (10/quartile) in buffer area. In core area 10 quadrats were laid randomly to enumerated trees, shrubs, and herbs as per the Following formulae used for calculating the frequency (%), abundance and density of the floral species encountered in the 10 quadrats studied.

Quadrats method

Quadrats of 25 × 25-m were laid down randomly within core and 5-km buffer area; each quadrat was laid to assess the trees (>5 cm GBH) and one, 10 × 10-m sub-quadrat nested within the quadrat for shrubs. The quadrats were laid randomly to cover the area to maximize the sampling efforts and minimize the species homogeneity, such as small stream area, trees in agricultural bunds, tank bunds, farm forestry plantations, wildlife areas, natural forest area, avenue plantations, house backyards, etc. In each quadrat individuals belonging to tree (25 × 25-m) and shrub (10 × 10-m) were recorded separately and have been identified on the field. Quadrates sampling methods is given in Fig no.3.26.

FIGURE 3.26: A SCHEMATIC DIAGRAM FOR FLORAL RANDOM SAMPLING



FLORA IN CORE ZONE

Taxonomically a total of 18 species belonging to 13 families have been recorded from the core mining lease area. The proposed mine lease area is exhibits almost plain topography. Based on the habitat classification of the enumerated plants the majority of species were Herbs 6 followed by Shrubs 3, Trees 5, Climber 1, and Grasses 2 and Cactus 2. Details of flora with the scientific name were mentioned in Table No. 3.1. The result of the core zone of flora studies shows that Fabaceae and Poaceae are the main dominating species in the study area mentioned in Table No.3.1 No species found as threatened category

a. Ziziphus oenoplia

b. Borassus flabellifer

c. Calotropis gigantea

d. Euphorbia antiquorum

e. Azadirachta indica

f. Eragrostis ferruginea

FLORA IN BUFFER ZONE

The buffer region has a similar type of habitat, but it has a wider variety of vegetation than the core zone area. The proposed mine lease area is exhibits almost plain topography. There are 134 different species identified in the buffer zone. Among the identified, floral (134) species were 44 trees, 39 herbs, 33 shrubs, 7 climbers, 8 grasses, and Cactus 2. According to the findings of the buffer zone flora studies, the dominant species in the study area are Fabaceae, Asteraceae, and Euphorbiaceae, as shown in Table No.3.2. Apart from the proposed project area, there is agricultural land. Horticulture and agricultural land are untouched. There are no Rare, Endangered, and

Threatened Flora species in the mining area and their surrounding study area. Details of flora with the scientific name were mentioned in Table No.3.2.

The most dominant species observed during the site survey of the study area are Prosopis juliflora (Velvet mesquite), Borassus flabellifer (Asian Palmyra palm), Dalbergia sisso (Tamarind), Vachellia nilotica (Gum arabic tree), etc. The shrubby vegetation is represented by Opuntia sp., Lantana camara (West Indian Lantana), Vitex negundo (Chinese chastetree), and Parthenium hysterophorus (Carrot grass),

A list of floral species has been prepared based on a primary survey (site observations) and discussion with local people. The total number of different plant life forms under trees, shrubs, herbs, and climbers is shown in Table 3.2 and their % distribution is shown in Figure 3.2.

TABLE 3.31: FLORA IN CORE ZONE

SI.No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	Velvet mesquite	Mullu Maram	*Prosopis juliflora*	Fabaceae
2.	Neem or Indian lilac	Vembu maram	*Azadirachta indica*	Meliaceae
3.	Jackal jujube	Surai Ilantai	*Ziziphus oenoplia*	Rhamnaceae
4.	Millettia Pinnata	Pongam oiltree	*Pongamia pinnata*	Fabaceae
5.	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae
Shrubs				
1.	West Indian Lantana	Unni chedi	*Lantana camara*	Verbenaceae
2.	Devil's trumpet	Umathai	*Datura metel*	Solanaceae
3.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae
Herbs				
1.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
2.	Coat buttons	Thatha poo	*Tridax procumbens*	Asteraceae
3.	Devil‘s thorn	Nerunji	*Tribulus terrestris*	Zygophyllales
4.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
5.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae
6.	Indian nettle	Nayuruvi	*Achyranthes aspera*	Amaranthaceae
Climber				
1.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae
Grasses				
2.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae
3.	Great brome	Thodappam	*Bromus diandrus*	Poaceae
Cactus				
1.	Triangular spruge	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae

TABLE 3.32: FLORA IN BUFFER ZONE

SI.No	English Name	Vernacular Name	Scientific Name	Family Name
Trees				
1.	White-bark acacia	Velvelam	Acacia leucophloea	Mimosaceae
2.	Coconut	Thennai maram	*Cocos nucifera*	Arecaceae
3.	Neem or Indian lilac	Vembu	*Azadirachta indica*	Meliaceae
4.	Velvet mesquite	Mullu Maram	*Prosopis juliflora*	Fabaceae
5.	Frywood	Vaagai	*Albizia lebbeck*	Mimosaceae
6.	Indian plum	Elanthai maram	*Ziziphus mauritiana*	Rhamnaceae
7.	Pongamia pinnata	Pongam	*Millettia pinnata*	Fabaceae

8.	Oil cake tree	Wunja	*Albizia amara*	Fabaceae
9.	Eucalyptus	Thailam maram	*Eucalyptus tereticornis*	Myrtaceae
10.	Velvet mesquite	Velikatthaan	*Prosopis juliflora*	Fabaceae
11.	River tamarind	Savunda	*Leucaenaleucocephala*	Fabaceae
12.	Madras thorn	Kudukapuli	*Pithecellobium dulce*	Fabaceae
13.	Portia tree	Poovarasan	*Thespesia Populnea*	Malvaceae
14.	Lemon	Ezhumuchaipalam	*Citrus lemon*	Rutaceae
15.	Jamun Fruit Plant	Naval maram	*Syzygium cumini*	Myrtaceae
16.	Gum arabic tree	Karuvelam	*Vachellia nilotica*	Fabaceae
17.	Kassod Tree	ManjalKonrai	*Cassia siamea*	Fabaceae
18.	Chinaberry	Malaivembu	*Meliaazedarach*	Meliaceae
19.	Sudu	Kalli	*Euphorbia antiquorum*	Euphorbiaceae
20.	Monkey pod tree	Kondraimaram	*Samaneasaman*	Fabaceae
21.	Asian Palmyra palm	Panai maram	*Borassus flabellifer*	Arecaceae
22.	Bamboo	Moongil	*Bambusoideae*	Poaceae
23.	Indian-almond	Vadamaram	*Terminaliacatappa*	Fabaceae
24.	Teak	Thekku	*Tectona grandis*	Verbenaceae
25.	Mahua	Iluppai	*Bassia latifolia*	Sapotaceae
26.	Indian mulberry	Nuna maram	*Morinda tinctoria*	Rubiaceae
27.	Banyan	Alai	*Ficus benghalensis*	Moraceae
28.	Yellow Flame	Iyalvagai	*Peltophorumpterocarpum*	Fabaceae
29.	Cashew	Munthiri	*Anacardium occidentale*	Anacardiaceae
30.	Common fig	Athi Maram	*Ficus Carica*	Anacardiaceae
31.	Horsetail She-oak	Savukku maram	*Casuarina equisetifolia*	Casuarinaceae
32.	Tamarind	Puliyamaram	*Tamarindus indica*	Legumes
33.	Phoenix sylvestris	Pereatchai	*Phoenix sylvestris*	Arecaceae
34.	Creamy peacock flower	Perungondrai	*Delonix elata*	Fabaceae
35.	Sapodilla	Sappotta	*Manilkarazapota*	Sapotaceae
36.	Indian bael	Vilvam	*Aegle marmelos*	Rutaceae
37.	Indian gooseberry	Nelli	*Phyllanthus emblica*	Phyllanthaceae
38.	Guava	Koyya	*Psidium guajava*	Myrtaceae
39.	Mango	Manga	*Mangifera indica*	Anacardiaceae
40.	Sugar apple	Sitapalam	*Annona squamosal*	Annonaceae
41.	Papaya	Pappali maram	*Carica papaya L*	Caricaceae
42.	Banana tree	Vazhaimaram	*Musa acuminata*	Musaceae
43.	Jack fruit	Palamaram	*Artocarpus heterophyllus*	Moraceae
44.	Muntingia calabura	Singapore cherry	*Muntingiacalabura*	Malvaceae
Shrubs				
1.	Bush Morning Glory	Neiveli Kattamani	*Ipomoea carnea*	Convolvulaceae
2.	Chinese chastetree	Nochi	*Vitex negundo*	Lamiaceae
3.	Indian mallow	Thuthi	*Abutilon indicum*	Malvaceae
4.	Black-Honey Shrub	Ink Pazham	*Phyllanthus reticulatus*	Phyllanthaceae
5.	Jackal jujube	Surai Ilantai	*Ziziphus oenoplia*	Rhamnaceae
6.	Milk Weed	Erukku	*Calotropis gigantea*	Apocynaceae
7.	Jungle geranium	Vedchi	*Ixora coccinea*	Rubiaceae
8.	Solanum pubescens	Malaisundai	*Solanum pubescens Willd*	Solanaceae
9.	Plumeria alba	Malaiarali	*Plumeria alba*	Appocynaceae
10.	Night shade plan	Sundaika	*Solanum torvum*	Solanaceae
11.	Pinwheelflower	Nandiar vattai	*Tabernaemontana coronaria*	Apocynaceae
12.	Leaf Fig	Pie Aththi	*Ficus hispida*	Moraceae

13.	Stachytarpheta urticifolia	Rat tai	*Stachytarpheaurticifolia*	Verbenaceae
14.	Great bougainvillea	Kaakithapoo	*Bougainvillea spectabilis*	Nyctaginaceae
15.	Indian shot	Kalvalai	*Canna indica*	Cannaceae
16.	Devil's trumpet	Umathai	*Datura metel*	Solanaceae
17.	Jhahrberi	Narielandai	*Ziziphus nummularia*	Rhamnaceae
18.	Castor bean	Amanakku	*Ricinus communis*	Euphorbiaceae
19.	Shoe flower	Chemparuthi	*Hibiscu rosa-sinensis*	Malvaceae
20.	Nalta jute	Perattikkirai	*Corcorus olitorius*	Tiliaceae
21.	Bellyache bush	Kaatamanaku	*Jatropagossypifolia*	Euphorbiaceae
22.	Cape jasmine	Kumba poo	*Gardenia jasminoides*	Rubiaceae
23.	Touch-me-not	Thottalchinungi	*Mimosa pudica*	Mimosaceae
24.	Indian cork tree	Kattumalli	*Millingtonia hortensis*	Bignoniaceae
25.	Indian mallow	Maanikham	*Abutilon indicum*	Meliaceae
26.	Apple of sodom	Vellerukku	*Calotropis procera*	Asclepiadaceae
27.	Rough cocklebur	Marul-umattai	*Xanthium strumarium*	Asteraceae
28.	Pignut	Wild thulasi	*Hyptis suaveolens*	Lamiacea
29.	Avaram	Avarai	*Senna auriculata*	Fabaceae
30.	Wild caper bush	Kattukkathir	*Capparis sepiaria*	Capparaceae
31.	Indian Oleander	Arali	*Nerium indicum*	Apocynaceae
32.	Pencil cactus	Thirukalli	*Euphorbia tirucalli*	Euphorbiaceae
33.	West Indian Lantana	Unni chedi	*Lantana camara*	Verbenaceae
Herbs				
1.	Mexican prickly poppy	Kudiyotti	*Argemone mexicana*	Papaveraceae
2.	Purple pitcher plant	Kavali	*Tephrosia purpurea*	Fabaceae
3.	Red Pea Eggplant	Vellai tuduvalai	*Solanum trilobatum*	Solanaceae
4.	Bindii	Nerunji Mull	*Tribulus terrestris*	Zygophyllaceae
5.	Chamber bitter	Malai Kizhanelli	*Phyllanthus urinaria L.*	Euphorbiaceae
6.	Carrot grass	Vishapoondu	*Parthenium hysterophorus*	Asteraceae
7.	Billygoat weed	Pumpillu	*Ageratum conyzoides*	Asteraceae
8.	Green amaranth	Kuppaikeerai	*Amaranthus viridis*	Amaranthaceae
9.	Aloe barbadensis	Katrazhai	*Aloe vera*	Asphodelaceae
10.	Indian Mercury	Kuppamani	*Acalypha indica*	Euphorbiaceae
11.	Indian nettle	Nayuruvi	*Achyranthes aspera*	Amaranthaceae
12.	Indian doab	Arugampul	*Cynodon dactylon*	Poaceae
13.	Rushfoil	Milakai Poondu	*Croton sparsiflorus*	Euphorbiaceae
14.	Rough cocklebur	Marul-umattai	*Xanthium strumarium*	Asteraceae
15.	Benghal dayflower	Kanavachai	*Commelina benghalensis*	Commelinacea
16.	Septicweed	Kattuttakarai	*Senna occidentalis*	Fabaceae
17.	Mountain knotgrass	Sirupulai	*Aerva lanata*	Amaranthaceae
18.	Tickweed	Nai kadugu	*Celome viscosa*	Capparidaceae
19.	Egyptian senna	Mayurkondrai	*Cassia tora*	Caesalpiniacea
20.	Common leucas	Thumbai	*Leucas aspera*	Lamiaceae
21.	Fish poison	Kollukkai Vela	*Tephrosia purpurea*	Fabaceae
22.	Painted euphorbia	Pal perukki	*Euphorbia heterophyla*	Euphorbiaceae
23.	Pig weed	Mukkarattai Keerai	*Boerheavia diffusa*	Nyctaginaceae
24.	Asthma-plant	Amman pacharisi	*Euphorbia hirta*	Euphorbiaceae
25.	Poor land flatsedg	Kunnakora	*Cyperus compressus*	Cyperaceae
26.	Marsh Barbel	Neermulli	*Hygrophila auriculata*	Acanthaceae
27.	Bhringaraj	Karisalankanni	*Eclipta alba*	Asteraceae
28.	Spiny amaranth	Mullukkirai	*Amaranthus spinosus*	Amaranthaceae

29.	Holy basil	Thulasi	*Ocimum tenuiflorum*	Lamiaceae
30.	Indian Turnsole	Thel kodukku	*Heliotropium indicum*	Boraginaceae
31.	Tridax daisy	Thatha poo	*Tridax procumbens*	Asteraceae
32.	Globe Amaranth	Vaadamalli	*Gomphrena globosa*	Amaranthaceae
33.	Dwarf morning-glory	Vishnukranti	*Evolvulus alsinoides*	Convolvulaceae
34.	White head	Vellarugu	*Enicostemma axillare*	Gentianaceae
35.	Rushfoil	Reilpoondu	*Croton sparsiflorus*	Euphorbiaceae
36.	Negro Coffee	Payaverai	*Cassia occidentalis*	Caesalpiniacea
37.	Gale of the wind	Keelaneeli	*Phyllanthus niruri*	Phyllanthaceae
38.	Obscure Morning Glory	Chirutali	*Ipomea obscura*	Convolvulaceae
39.	Arrowleaf sida,	Jelly Leaf	*Sida rhombifolia*	Malvaceae
Climber				
1.	Balloon vine	Mudakathan	*Cardiospermum halicacabum*	Sapindaceae
2.	Ivy gourd	Kovai	*Coccinia grandis*	Cucurbitaceae
3.	Wild water lemon	Poonai puduku chedi	*Passiflora foetida*	Passifloraceae
4.	Stemmed vine	Perandai	*Cissus quadrangularis*	Vitaceae
5.	Stinking passionflower	Poonai puduku chedi	*Passiflora foetida L*	Passifloraceae
6.	Butterfly pea	Sangu poo	*Clitoria ternatea*	Fabaceae
7.	Rosary pea	Kundumani	*abrus precatorius*	Fabaceae
Grass				
1.	Great brome	Thodappam	*Bromus diandrus*	Poaceae
2.	Windmill grass	Chevvarakupul	*Chloris barbata*	Amaranthaceae
3.	Eragrostis	Pullu	*Eragrostis ferruginea*	Poaceae
4.	Watergrass	Mukkutikorei	*Bulbostylis barbatta*	Cyperaceae
5.	Finger grass	Kuruthupillu	*Chloris dolichostachya*	Poaceae
6.	Umbrella-sedge	Vattakorai	*Cyperus difformis*	Cyperaceae
7.	Marvel grass	Marvel grass	*Dichanthium annulatum*	Poaceae
8.	Tropical crabgrass	Crab grass	*Digetaria adscendens*	Poaceae
Cactus				
1.	Prickly pear	Nagathali	*Opuntia*	Cactaceae
2.	Triangular spruge	Chaturakalli	*Euphorbia antiquorum*	Euphorbiaceae

*E- Economical, M- Medicinal, EM- Both Economical and Medicinal, NE- Not evaluated

Source:

- Nair.N.C and A.N. Henry, Flora of Tamil Nadu 1983, Series 1, Botanical Survey of India, Southern Circle.

3.5. Aquatic flora and Fauna

Mining activities will not have an impact on aquatic ecosystems because no effluent discharge from the Rough Stone and Gravel quarry is planned. There are no natural perennial surface water bodies, such as marshes, rivers, streams, lakes, or agricultural sites, inside the mining lease area. The study region contains a few seasonal bodies of water. Kilsevur Lake is located 4.5 kilometres to the northwest, followed by Perumukkal Lake, which is located 4.5 kilometres to the west. Bhrammadesam Lake is 2.5 kilometres to the southwest, Munnur Lake is roughly 4 kilometres to the southeast, and so on. Aquatic weeds have been discovered growing in every water bog, pond, and so on within a 10 km radius. Typha angustata can be seen growing along village drains and tiny water-logged depressions.

Table No: 3.4. List of aquatic plants observed in the study area (Buffer zone

Sl.No	Scientific name	Common Name	Vernacular Name (Tamil)	IUCN Red List of Threatened Species
1.	*Eichornia crassipe*	Water hyacinth	Agayatamarai	NA
2.	*Aponogetonnatans*	Floating lace plant	Kottikizhnagu	NA
3.	*Nymphaea nouchali*	Blue water lily	Nellambal	LC
4.	*Typha angustifolia*	Sambu	Narrowleaf cattail	LC
5.	*Carex cruciata*	Cross Grass	Koraipullu	NA
6.	*Cyperus exaltatus*	Tall Flat Sedge	Koraikizhangu	LC

***LC- Least Concern, NA-Not yet assessed**

***LC- Least Concern, NA-Not yet assessed**

a. Cross Grass

b. Sambu

c. Blue water lily

d.Water hyacinth

3.5.1.Fishes

Fish is commonly found in all types of natural water bodies and very common source of food in Easterner South India. The local fishermen were enquired and also the secondary resources were reviewed to collect information on the fishes found in the study area. Few common species are; Catla (Catla catla), Mrigal (Cirrhinus mrigala), Tank goby (Glossogobius giuris), Ticto barb (Pethia ticto), Greenstripe barb (Puntius vittatus), Roho (Labeo rohita) and Pool barb (Puntius sophore) etc., Species of fish reported in the study area are given in table 3.12. During the field investigation, all of the lakes were quite dry. Only the lakes gather fish data.

Table 3.12. Based on Actual Sighting, based on inputs from locals and Perused from Secondary Data

S.No	Common name	Scientific name	Family
1.	Ticto barb	*Pethia ticto*	Cyprinidae
2.	Tank goby	*Glossogobius giuris*	Gobiidae
3.	Mrigal	*Cirrhinus mrigala*	Chordata
4.	Rohu	*Labeo rohita*	Cyprinidae
5.	Catfish	*Siluriformes*	Diplomystidae
6.	Greenstripe barb	*Puntius vittatus*	Cyprininae
7.	Pool barb	*Puntius sophore*	Cyprinidae

FAUNA

The faunal survey has been carried out as per the methodology cited and listed out Mammals, birds, Reptiles, Amphibians and Butterflies. All the listed species were compared with Red Data Book and Indian Wildlife Protection Act, 1972. There are no rare, endangered, threatened (RET) and endemic species present in core area.

FAUNA METHODOLOGY

The study of fauna takes substantial amount of time to understand the specific faunal characteristics of the area. The assessment of fauna has been done on the bases of primary data collected from the lease sites. The presence was also confirmed from the local inhabitants depending on the animal sightings and the frequency of their visits in the project area. In addition, officials, local peoples were another source of information for studying the fauna of the area. Field activities are physical/active search, covering rocks, burrows, hollow inspection and location of nesting sites and habitat assessment etc. Taxonomical identification was done by the field guide book and wildlife envis data base (wiienvis.nic.in/Database/Schedule Species Database) and Zoological Survey of India (ZSI). Detailed faunas are mentioned in the Table No. 3.36 and 3.37.

Survey and Monitoring of Mammals

Intensive survey has been done by line transect methods (Walking and in vehicle) for all major habitats for surveying of mammals by direct and indirect evidence. Indirect methods such as faecal matter (i.e., scat) and pug mark by establishing 10 × 100-m linear transects depending on the habitat (i.e., existing wildlife game routes/forest trails used).

Direct observation technique has been used for surveying large and medium sized mammals. But this technique is perfectly suitable for surveying of diurnal mammals; however, good photographs were also taken for species identification.

Survey and Monitoring of Birds

Birds are sampled by using point count methods, and opportunistic bird sightings. By this bird vocal sounds and photographs, the species were identified in consultation with village local people.

Point count: in these methods, the observer will stand in a randomly chosen point and birds seen or heard in 50m radius are recorded for 5-min. this observation is repeated in another point at least 30m from the first point. We have enumerated 20 point – counts in each quartile, which constitute a total of 80 points-count (20 x 4) within 10 km radius area.

Opportunistic bird sightings: while traveling in study area, many bird species will be detected in survey time. Such species are recoded by their appearance or by their call.

Survey and Monitoring of reptiles

Several survey techniques such as standard walk transect visual encounter survey methods were used to sampling reptiles in each and every habitat of the study area. While doing this survey, photographs were taken for identification of species. Species identification was done by using standard field guides in consultation with village people expert.

The butterfly was enumerated by 2 linear transects of 10 × 100 m were laid within each quartile at minimum interval of 1 km. Further, amphibians and fishes documented in existing literature and secondary information in consultation with local people and wildlife experts.

FAUNA IN CORE ZONE

A total of 26 varieties of species were observed in the Core zone of Enthoor Village, Rough stone and gravel quarry (Table No.3.3) among them numbers Insects 8, Reptiles 3, Mammals 2, and Avians 13. A total of 26 species belonging to 18 families have been recorded from the core mining lease area. None of these species are threatened or endemic in the study area and surroundings. There is no Schedule I species and twelve species are under Schedule IV according to the Indian Wildlife Act 1972. A total of 13 species of bird were sighted in the mining lease area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. Details of fauna in the core zone with the scientific name were mentioned in Table No. 3.34.

TABLE 3.34: FAUNA IN CORE ZONE

SI. No	Common Name	Scientific Name	Schedule list WLPA 1972	IUCN Red List data
Insects				
1.	Striped tiger	*Danaus plexippus*	Schedule IV	LC
2.	Colotis danae	*Colotis danae*	NL	LC
3.	Grasshopper	*Hieroglyphus sp*	NL	LC
4.	Chocolate pansy	*Junonia iphita*	NL	LC
5.	Common Tiger	*Danaus genutia*	NL	NL
6.	Termite	*Hamitermes silvestri*	NE	LC
7.	Red-veined darter	*Sympetrum fonscolombii*	NL	LC
8.	Tawny coster	*Danaus chrysippus*	Schedule IV	LC
Reptiles				
1.	Garden lizard	*Calotes versicolor*	NL	LC
2.	Common skink	*Mabuya carinatus*	NL	LC
3.	Green vine snake	*Ahaetulla nasuta*	Schedule IV	NL
Mammals				
1.	Indian Field Mouse	*Mus booduga*	Schedule IV	NL
2.	Asian Small Mongoose	*Herpestes javanicus*	Schedule (Part II)	LC
Aves				
1.	Common myna	*Acridotheres tristis*	NL	LC
2.	House crow	*Corvussplendens*	NL	LC
3.	Koel	*Eudynamys*	Schedule IV	LC
4.	Asian green bee-eater	*Meropsorientalis*	NL	LC
5.	Rose-ringed parkeet	*Psittacula krameri*	NL	LC
6.	Common quail	*Coturnix coturnix*	Schedule IV	LC
7.	Black drongo	*Dicrurus macrocercus*	Schedule IV	LC
8.	Cattle egret	*Bubulcus ibis*	NE	LC
9.	Shikra	*Laniusexcubitor*	Schedule IV	LC
10.	Paddy Bird	*Ardea grayii grayii*	Schedule IV	LC
11.	Rock pigeon	*Columbidae*	Schedule IV	LC
12.	Indian Robin	*Saxicoloides fulicata*	Schedule IV	LC
13.	Pond-Heron	*Ardeo labacchus*	Schedule IV	LC

*NE- Not evaluated; LC- Least Concern, NT –Near Threatened, T-Threatened

FAUNA IN BUFFER ZONE

As animals, especially vertebrates move from place to place in search of food, shelter, mate or other biological needs, separate lists for core and buffer areas are not feasible however, a separate list of fauna pertaining to core and buffer zone are listed separately. Though there are no reserved forest in the buffer zone. As such there are no chances of occurrence of any rare or endangered or endemic or threatened (REET) species within the core or buffer area.

There are no Sanctuaries, National Parks, Tiger Reserve or Biosphere Reserve or Elephant Corridor or other protected areas within 10 km radius from the core area. It is evident from the available records, reports, and circumstantial evidence that the entire study area including the core and buffer areas were free from any endangered animals. There were no resident birds other than common bird species such as green bee-eaters, Indian blue robin, Common Mynas, Black drangos, Crows, etc.

The list of bird species recorded during the field survey and literature from the study area is given in Table 3.7. The list of reptilian species recorded during the field survey and literature from the study area are given in Table 3.8. The list of insect species recorded during the field survey and literature from the study area are given in Table 3.9. The list of Amphibian species recorded during the field survey and literature from the study area are given in Table 3.10 and List of Butterflies identified from the project site and their conservation status is given in Table No.3.11. It is apparent from the list that none of the species either spotted or reported is included in Schedule I of the Wildlife Protection Act. Similarly, none of them comes under the REET category.

Taxonomically a total of 62 species were identified from the project site. Based on habitat classification the majority of species were Insects 6, followed by birds 23, Reptiles 9, Mammals 6, amphibians 2, and Butterflies 16. A total of 23 species of bird were sighted in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. There are no impacts on nearby fauna species.

Dominant species are mostly birds and buffer flies, and two were observed during the extensive field visit Ranahexadactyla, and Ranatigrina. There is no schedule I Species in the study area. There are no critically endangered, endangered, vulnerable, and endemic species were observed. Table No.3.35.

TABLE 3.35: FAUNA IN BUFFER ZONE

SI. No	Scientific Name	Common Name	IUCN Conservation Status
1.	Funambulus palmarum	Indian palm squirrel	LC
2.	Mus booduga	Indian Field Mouse	LC
3.	Herpestes javanicus	Asian Small Mongoose	LC
4.	Lepus nigricollis	Indian hare	LC
5.	Rattus norwegicus	Brown rat	LC
6.	Lepus nigricollis	Rabbit	LC
Listed birds			
SI. No	**Scientific Name**	**Common Name**	**IUCN Conservation Status**
1.	Bubulcus ibis	Cattle Egret	LC
2.	Saxicoloidesfulicata	Indian Robin	LC
3.	Streptopeliachinensis	Spotted Dove	LC
4.	Accipiter badius	Shikra	LC
5.	Coraciasbenghalensis	Indian Roller	LC
6.	Anthusrufulus	Paddyfield Pipit	LC
7.	Nectarinia minima	Small Sunbird	LC
8.	Acridotherestristis	Common Myna	LC
9.	Vanellusindicus	Red-wattled Lapwing	-
10.	Dicrurusmacrocercus	Black Drongo	LC
11.	Lonchurapunctulata	Spotted Munia	LC
12.	Dendrocittavagabunda	Indian Treepie	LC
13.	Corvussplendens	House Crow	LC
14.	Eudynamys	Koel	LC
15.	Psittacula krameni	Rose ringed parakeet	LC
16.	Dicrurus macrocercus	Black drongo	LC
17.	Corvus splendens	House crow	LC
18.	Alcedo atthis	Small blue kingfisher	LC

19.	Cuculus canorus	Common Cukoo	LC
20.	Pycnonotus cafer	Red vented Bulbul	LC
21.	Milvus migrans	Black kite	LC
22.	Meropsorientalis	Small Bee-eater	LC
23.	Halcyon smyrnensis	White-breasted Kingfisher	LC

List of Reptiles

SI. No	Scientific Name	Common Name	IUCN Red List data
1.	Calotes versicolor	Oriental garden lizard	LC
2.	Hemidactylus flaviviridis	House lizards	NL
3.	Naja naja	Indian cobra	LC
4.	Vipera russseli	Russell's viper	NL
5.	Ahaetulla nasuta	Green vine snake	LC
6.	Ptyas mucosa	Rat snake	NA
7.	Nerodiapiscator	Freshwater snake	NA
8.	Bungarus caeruleus	Common krait	LC
9.	Mabuya carinatus	Common skink	LC

List of Insects

SI. No	Scientific Name	Common Name	IUCN Conservation Status
1.	Apis cerana	Indian honey bee	-
2.	Hamitermes silvestri	Termite	LC
3.	Hieroglyphus sp	Grasshopper	LC
4.	Camponotus Vicinus	Ant	NL
5.	Ceratogomphus pictus	Dragonfly	-
6.	Sympetrum fonscolombi	Dragonfly	-

List of Butterflies

SI. No	Scientific Name	Common Name	IUCN Conservation Status
1.	Danaus genutia	Striped Tiger	LC
2.	Danaus chrysippuschrysippus	Plain Tiger	LC
3.	Danaus genutia	Common Tiger	
4.	Acraea terpsicore	Tawny Coster	LC
5.	Papiliopolytespolytes	Common Mormon	LC
6.	Papiliodemoleusdemoleus	Lime Butterfly	LC
7.	Hypolimnasmisippus	DanaidEggfly	LC
8.	Catopsilia pyranthe	Mottled emigrant	LC
9.	Junoniahierta	Yellow Pansy	LC
10.	Junonialemonias	Lemon Pansy	LC
11.	Hypolimnasmisippus	DanaidEggfly	LC
12.	Euchrysopscnejus	Gram Blue	LC
13.	Euploea core	Common Crow	LC
14.	Melanitisledaleda	Common Evening Brown	LC
15.	Colotis danae	Crimson tip	LC
16.	Junonia iphita	Chocolate pansy	LC

*NL- Not listed, LC- Least concern, NT- Near threatened

1. Calotes versicolor

2. Ceratogomphus pictus

3. Sympetrum fonscolombii

4. Psittacula krameri

5. Colotis danae

6. Catopsilia pyranthe

7.Danaus chrysippus

8.Zizina Otis indica

9. Chocolate pansy

10.Dicrurus macrocercus

3.5.4 Interpretation & Conclusion:

There is no schedule I species of animals observed within study area as per Wildlife Protection Act 1972 as well as no species is in vulnerable, endangered or threatened category as per IUCN. There is no endangered red list species found in the study area. Hence this small mining operation over short period of time will not have any significant impact on the surrounding flora and fauna.

3.6 SOCIO ECONOMIC ENVIRONMENT

The major developmental activities in mining /Industrial sector are required for economic development as well as creation of employment opportunities (direct and indirect) and to meet the basic/modern needs of the society, which ultimately results in overall improvement of the quality of life through upliftment of social, economic, health, education and nutritional status in the project region, state as well as the country. In this manner all developmental projects have direct as well as indirect relationships with socioeconomic aspects, which also include public acceptability for new developmental projects. Thus, the study of socioeconomic component incorporating various facets related to prevailing social and cultural conditions and economic status of the Roughstone and Gravel quarry project region is an important part of EIA study. The study of these parameters helps in identification, prediction and evaluation of the likely impacts on the socio economics and parameters of human interest due to the project.

3.6.1 Objectives of the Study

The objectives of the socio-economic impact assessment are as follows:

a) To study the socio-economic status of the people living in the study area of the project.

b) To identify the basic needs of the nearby villages within the study area.

c) To assess the impact on socio-economic environment due to the project.

d) To provide the employment and improved living standards.

e) To study the socio-economic status of the people living in the study area Roughstone and Gravel quarry project region

f) To assess the impact on socio-economic environment due to Roughstone and Gravel quarry project region

g) To analysis of impact of socio economic and Environmental Infrastructure facilities and road accessibility.

3.6.2 Scope of Work

- To study the Socio-economic Environment of area from the secondary sources
- Developing a questionnaire for Survey
- Data Collection and Analysis
- Identification of impacts due to the mining projects
- Mitigation Measures

3.6.3 Methodology

The methodology adopted for the socio-economic impact assessment is as follows:
a) The details of the activities and population structure have been obtained from Census 2001 and 2011 and analyzed.
b) Based on the above data, impacts due to plant operation on the community have been assessed and recommendations for further improvement have been made.

3.6.4 Sources of Information and Data Base

To achieve the above objectives, the information has been collected from both primary and secondary sources. Both primary data and secondary data have been analyzed by means of suitable statistical techniques for the purpose of verifying the above selected hypotheses concerned with the surrounding area.

3.6.5 Primary Survey

The primary data collection includes the collection of data through a structured interview schedule by direct observation method. The questionnaire survey includes both open and closed methods. The sample size is limited respondents, who were selected on the basis of simple random sampling from Endur Village, Markkanam Taluk, Viluppuram District, Tamilnadu State. in the field survey has been divided into three major segments namely Primary Zone (0 - 3 km), Secondary Zone (3 - 7 km) and tertiary Zone (7 - 10 km).

The questionnaires were designed to suit the subjects considering their rural background enabling to furnish correct information and data as far as possible. Data were collected at village level and household level by questionnaires and focused group discussions.

The study area for the field survey has been divided into three major segments namely Primary Zone (0 - 3 km), Secondary Zone (3 - 7 km) and Outer Zone (7 - 10 km).

3.6.6 Collection of Data from Secondary Sources

Data from secondary sources were collected on following aspects:

- Demographic profile of the area
- Economic profile of the area

Table 3.6.1 Type of Information and Sources

Information	Source
Demography	District Census Handbook, Govt. of India
Economic profile of the area	Census of India, Tamil Nadu State

b) Data Presentation and Analysis

The data collected were presented in a suitable, concise form i.e., tabular or diagrammatic or graphic form for further analysis. These tabulated data were interpreted and analyzed with the help of various qualitative techniques and ideographic approaches.

3.7 Background Information of the Area

Tamil Nadu is the 11th largest states in India in terms of area. The state is the seventh most populous state in the country and its main language Tamil has origins that date back to 500 BC. Chennai is the capital of Tamil Nadu and lies on the eastern coast line of India. Tamil Nadu is famous for its wonderful temples and monuments that have been built 1000s of years ago and has places that have been marked as heritage sites by the United Nations. In a 180 degree paradigm shift, this state with a rich historical importance is also one of the fastest developing centre for technology and trade.

The State can be divided broadly into two natural divisions (a) the Coastal plains of South India and (b) the hilly western area. Parallel to the coast and gradually rising from it is the broad strip of plain country. It can further be subdivided into coromandal plains comprising the districts of Viluppuram , Viluppuram , Cuddalore and Vellore. The alluvial plains of the Cauvery Delta extending over Thanjavur and part of Tiruchirapally districts and dry southern plains in Madurai, Dindigul, Ramanathapuram, Sivaganga, Virudhnagar, Tirunelveli and Tuticorin districts. It extends a little beyond Western Ghats in Kanyakumari District. The Cauvery Delta presents some extremely distinctive physical and human

features, its power being a main factor in the remarkable growth, the towns of Tamilnadu have witnessed.

3.8 Geography of the Area

Tamil Nadu is one of the 28 states of India, located in the southernmost part of the country. It extends from 8°4'N to 13°35'N latitudes and from 76°18'E to 80°20'E longitudes. Its extremities are

- in eastern - Point Calimere
- in western - hills of Anaimalai
- in northern - Pulicat lake
- in southern - Cape Comorin

It covers an area of 1,30,058 sq.km and 11th largest state in India. It covers 4% of the area of our country. Tamil Nadu is bounded by the Bay of Bengal in the east, Kerala in the west, Andhra Pradesh in the north, Tamil Nadu in the northwest and Indian Ocean in the south. Gulf of Mannar and Palk Strait separate Tamil Nadu from the Island of Sri Lanka, which lies to the southeast of India.

Already we have learnt that the state of Tamil Nadu had only 13 districts at the time of its formation. After that, the state was reorganised several times for the administrative convenience. At present there are 37 districts in Tamil Nadu, including the newly created districts such as Kallakurichi, Tenkasi, Chengalpet, Ranipet and Tirupathur.

3.9 Population Growth Rate

In 1991, there were only 21 districts in the State of Tamil Nadu. In 2001, eight new districts were created by reorganising the territorial jurisdiction. The nine districts are – Viluppuram , Namakkal, Viluppuram , Perambalur, Viluppuram, Thiruvarur, Nagapattinam, and Theni. The population and its growth trend are important economic factors in a developing economy.

Year	Tamil Nadu	India
1941	11.91	14.22
1951	14.66	13.31
1961	11.85	21.51
1971	22.30	24.80
1981	17.50	24.66
1991	15.39	23.86
2001	11.19	21.34
2011	15.61	5.96
2021	5.96	1.0

3.10 Villupuram District

Viluppuram (also Villupuram and Vizhupuram) is one of the thirty-two districts of Tamil Nadu state located on the southern tip of India. The district headquarters is located at Viluppuram. Viluppuram district came into existence on 30th September 1993 when it was created out of South Arcot district. Viluppuram is the largest district in the state.

Location

Viluppuram District lies between 11 38′ 25″ N and 12 20′ 44″ S: 78 15′ 00″ W and 79 42′ 55″ E with an area of 3725.54 Sq. Kms. It is surrounded on East and South by Cuddalore District. The West by Kallakurichi District and on the North by Thiruvannamalai and Kanchipuram District.

At present Vilupuram district comprises of 2 Revenue Divisions, 9 Administrative Taluks, 932 Revenue Villages, 2 Municipalities, 8 Town Panchayats, 13 Blocks and 693 Village Panchayats.

Source: https://viluppuram.nic.in/about-district/

Viluppuram District in Population Growth:

Year	Projected Population	
2011	3,458,873	34.59 Lakhs
2021	3,950,000	39.54 Lakhs
2022	4,000,000	40.02 Lakhs
2023	4,040,000	40.43 Lakhs
2024	4,070,000	40.79 Lakhs
2025	4,100,000	41.09 Lakhs
2026	4,130,000	41.36 Lakhs
2027	4,150,000	41.58 Lakhs
2028	4,170,000	41.77 Lakhs

Source: https://www.census2011.co.in/census/district/27-viluppuram.html

3.11 Study Area

Detailed socio-economic survey was conducted in the study area (Core and buffer zone) within 10 km radius of the area at Endur Village, Markkanam Taluk, Viluppuram District, Tamilnadu State. State. In order to determine the impact of the proposed project on nature and inhabitant. To get an overview of the villagers and their perspectives about this proposed activity, different demographic parameters and social aspects such population density, sex ratio, literacy rate, worker ratio etc. has been identified, analyzed, studied together. These impacts may be beneficial or disadvantageous. If disadvantageous anticipated suggestions measures are advocated in order to have collective development.

3.12 Demographic pattern of 10km study area characteristics a comparative analysis

Table 3.12.1shows the socio-economic profile of the study area as compared to district, state and national level socio-economic profile

Particular	India	Tamil Nadu	Viluppuram District	Study Area (10km Radius)
Area (in sq. km.)	3,287,263	130058	7194	318
Population Density/ sq. Km.	368	554	481	187
No. of Households	249454252	13357027	800368	13915
Population	1210569573	72147030	3458873	59454
Male	623121843	36137975	1740819	29940
Female	587447730	36009055	1718054	29514
Scheduled Tribes	104281034	794697	74859	953
Scheduled Castes	201378086	14438445	1015716	24866
Literacy Rate	**72.99%**	**80%**	**72%**	**69%**
Sex Ratio (Females per 1000 Males)	**943**	**996**	**987**	**986**

Source: Census of India, 2011

Table no 3.12.1 show demographic pattern of India, Tamil Nadu, Viluppuram District & Study area (10km Radius). In India had total area of 3.2sqkm, State of Tamil Nadu area was 130058 sqkm, District of Viluppuram area was 7,194sqkm and study area is about 318 sqkm. Population density is total population per sqkm. So, India population density was 368sqkm, state of Tamil Nadu density was 554 sqkm, District had density about 481 sqkm and study area density is about 187sqkm. as per Census 2011, about 5.96percent of population in the state lives in areas. Viluppuram had comparing state wise 4.79percent of population lives in the district. In study area has 1.72 % around 10km radius. State, District and study area. In Tamil Nadu state SC categories people had about 20.02 %, District of Viluppuram

about 29.36 % it has increasing to Study area about 41.82% increasing in the total population Similarly ST population is about 1.10%, 2.16% and 1.60% of the total population in the study area. State level Literacy rate is 80%, district level is 72% but study area has almost decreased about 69%. There is literacy rate is study area decrease comparing district level decrease in the study area. Sex ratio female per thousand males about state level is 996, District level is 987and study area is 986.

The study area has population density 187 persons per sq.km of total population about 59454 as per census 2011. There were about 50.36 percent male and 49.64% female population. Study area has literate rate is about 69%. District had about 72% of literate rate as per census 2011.

3.13 Population Projection of the Study Area

A population projection is an estimation of the number of people expected to be alive at a future date that is made based on assumptions of population structure, fertility, mortality and migration. It is an essential to assess the need for new jobs, schools, doctors and nurses, planning urban housing, foods, clothing and requirements of energy and resources. It is also needed for policy discourse i.e., helps to the policy-makers to understand the existing problems and finally supports to develop the suitable solutions.

Table 3.13.1 Total Population of Study Area

Sl No.	Population in 2001	Population in 2011
1	55453	59454

Source: https://censusindia.gov.in/census.website/

Table 3.13.2 Population Projection of Study Area

S. No	Year	Projected Population (Approximately)
1.	2021	63455
2.	2031	67456
3.	2041	71457
4.	2051	75458

Source: Calculated by SPSS v29, 2022.

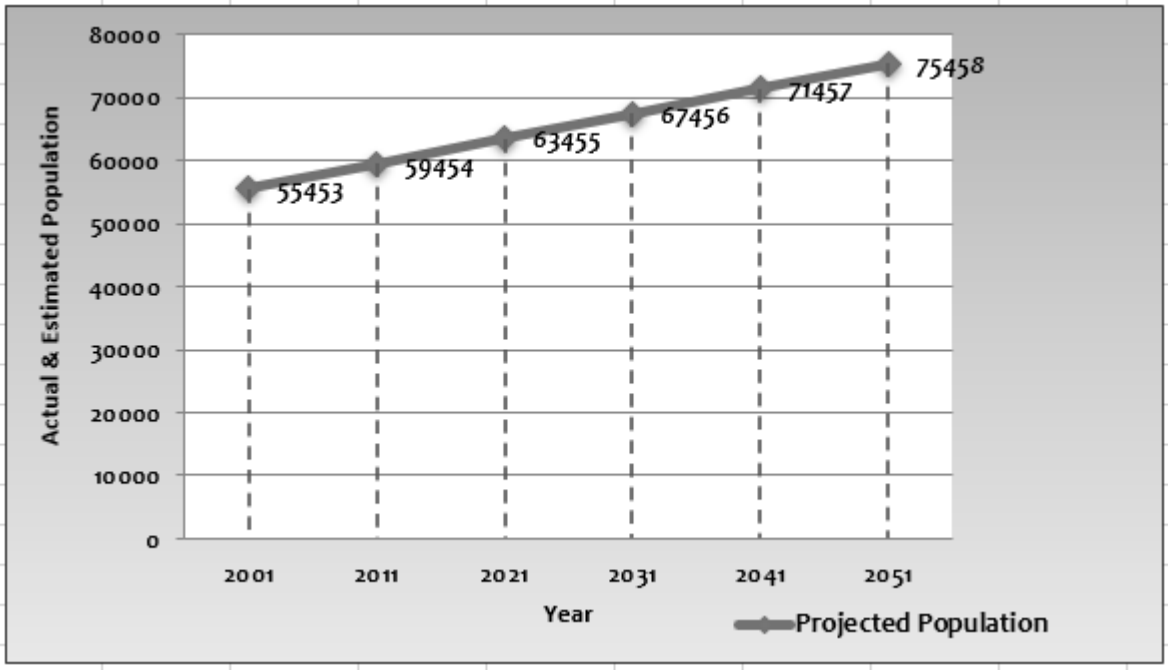


Fig 3.13.3 Graph Showing Population Projection

Following formula has been used for the projection of population.

$$Y=a+b_t$$

Where: Y= Dependent variable (Population)

a=Intercept

b=Slope

t=Interdependent variables (Time)

Above formula is applied to project population for the years (2021, 2031,2041,2051). Due to avoid the errors in manual calculation the statistical software SPSS (demo version 23) is used to calculate the intercept and the slope.

Due to the shortage of data on population the results show same value of growth for the years (2021,2031,2041,2051). If the researcher gets enough the data on population for earlier years the data projection will be accurate.

- Ref: Indian Economic survey, the SLR (Simple Linear Regression) techniques are used by statistical department, Government of India to project population.
- Source: https://www.ibm.com/in-en/analytics/spss-statistics-software

3.14 Population Growth of the Study Area

Table 3.14.1 Population Growth rate in Study area

Year	Actual Population	Growth Rate %
2001	55453	-
2011	59454	10.72
2021	63455	10.67
2031	67456	10.63
2041	71457	10.59
2051	75458	10.56

Source: Compiled by Author-2022

Above table no 3.14.1 is showing the growth rate of population since 2001, as per census in 2001 the population of study area was 55453 and 2011 it was 59454 if the population growth rate is 10.72%, it will approximately 63455 in year 2021 and 75458 in the year of 2051. It has approximately population growth rate decline will be 10.56%.

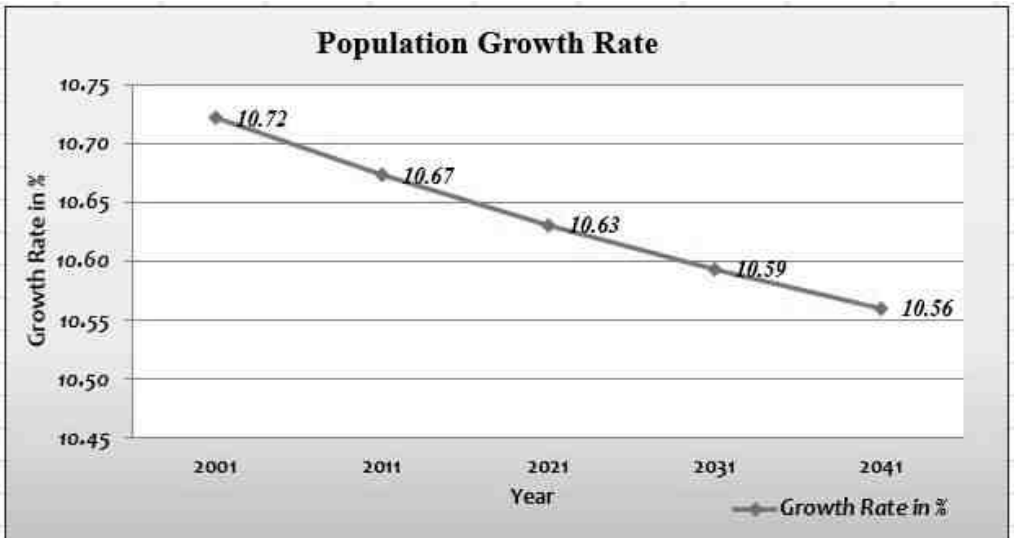


Fig.3.14.2Graph Showing Population Growth Rate

Planning Analysis:

Calculating Growth Rates

The percent change from one period to another is calculated from the formula:

Where:

$$PR = \frac{(V_{Present} - V_{Past})}{V_{Past}} x100$$

PR=PercentRate

$V_{Present}$ =PresentorFutureValue
V_{Past} = Past or Present Value

The *annual* percentage growth rate is simply the percent growth divided by N, the number of years.

Source: **https://pages.uoregon.edu/rgp/PPPM613/class8a.htm**

3.15 Population Distribution and Composition of Study Area

The population as per 2011 Census records is 59454 (for 10 km radius buffer zone). Total no. of household is 1397, 5275 and 7243 respectively, in primary, secondary and tertiary zone. Sex ratio is 989, 984 and 987 (females per 1000 males) observed in primary, secondary and tertiary zone respectively. SC population distribution is 2849,8655 and 13362 respectively in primary, secondary and tertiary zone. ST population distribution is 66,564,323 for primary, secondary and tertiary zone respectively. Average household size is 4. Zone wise Demographic profile of study area is given in the table 3.15.1 below:

Table 3.15.1 Zone wise Demographic Profile of Study Area

Zone	No. of Villages	Total Household	Total Population	Male Population	%	Female Population	%
Primary Zone (0 - 3 Km)	7	1397	5908	2971	50.29	2937	49.71
Secondary Zone (3 - 7 Km)	16	5275	22668	11427	50.41	11241	49.59
Tertiary Zone (7 - 10 km)	24	7243	30878	15542	50.33	15336	49.67
Study Area (0-10 km)	**47**	**13915**	**59454**	**29940**	**50.36**	**29514**	**49.64**

Source: Census of India, 2011

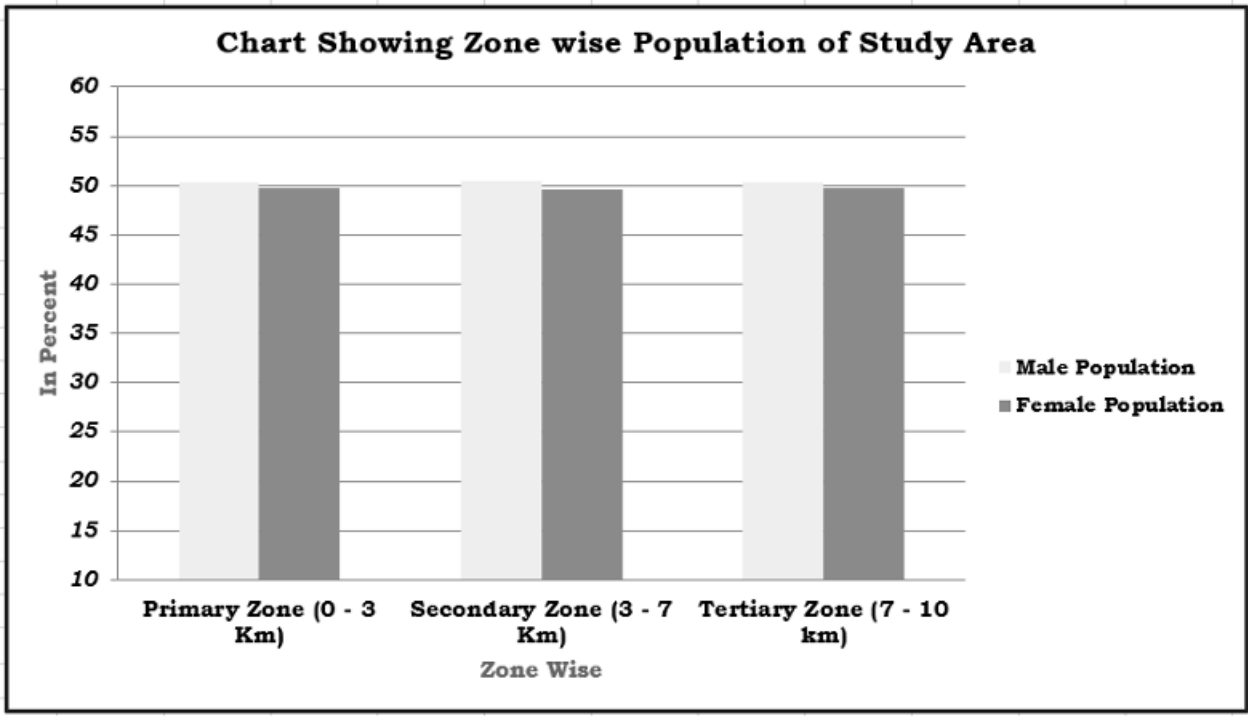


Figure 3.15.2 Population of study area

Table 3.15.3 Village wise Demographic Profile of the Study Area (Core and Buffer Zone)

Sno	Name	No.of Households	Total population	Total Male	Total Female	Population below 6	Male below 6	Female below 6	SC population	SC Male	SC Female	ST population	ST Male	ST Female	Literate population	Male Literate	Female Literate	Total workers	Main workers	Marginal workers	Non workers
0-3km																					
1	Nerkunam (Vada)	604	2495	1275	1220	301	158	143	278	145	133	42	23	19	1321	788	533	1486	1312	174	1009
2	Vandarampundi	21	60	31	29	5	3	2	0	0	0	5	3	2	26	15	11	46	4	42	14
3	Kunnappakkam	82	403	211	192	60	31	29	368	192	176	0	0	0	241	142	99	201	88	113	202
4	Tennampundi	127	543	271	272	51	25	26	441	220	221	9	5	4	376	199	177	338	47	291	205
5	Mandaperumpakkam	100	406	209	197	42	18	24	319	163	156	10	6	4	254	149	105	226	198	28	180
6	Madavantangal	50	153	71	82	21	10	11	5	3	2	0	0	0	81	44	37	91	86	5	62
7	**Endur**	413	1848	903	945	188	87	101	1438	699	739	0	0	0	1179	657	522	625	584	41	1223
		1397	**5908**	**2971**	**2937**	**668**	**332**	**336**	**2849**	**1422**	**1427**	**66**	**37**	**29**	**3478**	**1994**	**1484**	**3013**	**2319**	**694**	**2895**
3-7km																					
1	Kilpasar	250	1206	617	589	144	79	65	1075	553	522	10	5	5	680	385	295	653	171	482	553
2	Sendamangalam	317	1396	713	683	200	102	98	456	229	227	6	3	3	819	480	339	459	451	8	937
3	Pantodu	84	337	167	170	31	15	16	219	107	112	0	0	0	174	82	92	136	135	1	201
4	Nagalpakkam	123	470	235	235	46	23	23	243	122	121	0	0	0	270	172	98	261	101	160	209
5	Siruvadi	667	2913	1432	1481	316	155	161	1326	638	688	30	11	19	1959	1078	881	1251	1231	20	1662
6	Senalur	83	378	181	197	56	31	25	354	171	183	0	0	0	178	88	90	93	93	0	285
7	Buderi	199	844	440	404	95	59	36	450	248	202	0	0	0	530	317	213	354	293	61	490
8	Kurur	259	1079	551	528	119	59	60	436	225	211	18	8	10	646	399	247	591	282	309	488
9	Vepperi	104	485	245	240	57	31	26	329	167	162	57	22	35	316	181	135	147	147	0	338
10	Murukeri	278	1170	579	591	163	70	93	111	55	56	6	2	4	839	457	382	389	386	3	781
11	Sattamangalam	111	446	222	224	40	23	17	52	26	26	5	3	2	259	149	110	226	177	49	220
12	Singanandai	94	501	282	219	62	35	27	212	125	87	0	0	0	348	217	131	165	111	54	336
13	Alanguppam	476	2102	1051	1051	239	113	126	271	145	126	124	58	66	1157	648	509	1179	590	589	923
14	Manoor	886	3550	1793	1757	312	162	150	625	311	314	91	47	44	2181	1237	944	2171	2144	27	1379
15	Vanniper	616	2537	1283	1254	239	111	128	775	404	371	54	29	25	1795	1013	782	1655	1275	380	882
16	Bramaddesam	728	3254	1636	1618	361	183	178	1721	872	849	163	69	94	2020	1150	870	1560	1117	443	1694
		5275	**22668**	**11427**	**11241**	**2480**	**1251**	**1229**	**8655**	**4398**	**4257**	**564**	**257**	**307**	**14171**	**8053**	**6118**	**11290**	**8704**	**2586**	**11378**
7-10km																					
1	Kambur	268	1163	587	576	99	53	46	676	342	334	10	5	5	713	399	314	473	193	280	690
2	Annambakkam	299	1283	660	623	115	61	54	440	242	198	7	3	4	893	516	377	775	274	501	508
3	Kattupunjai	82	322	164	158	47	25	22	40	22	18	0	0	0	158	97	61	182	93	89	140
4	Kadavambakkam	397	1798	885	913	192	100	92	1183	593	590	0	0	0	990	533	457	680	400	280	1118
5	Vittalapuram	449	1985	1013	972	204	98	106	1140	595	545	9	5	4	1368	761	607	1129	1049	80	856
6	Nolambur	865	3523	1746	1777	371	186	185	1322	654	668	86	44	42	2124	1212	912	1895	1079	816	1628
7	Asappur	271	1114	551	563	90	44	46	337	170	167	0	0	0	748	422	326	665	651	14	449
8	Kurumparam	58	228	106	122	34	13	21	32	14	18	8	4	4	169	86	83	137	60	77	91
9	Alathur	448	1894	925	969	192	97	95	917	433	484	0	0	0	1122	624	498	1075	1041	34	819
10	Kattalai	365	1453	723	730	163	76	87	3	2	1	0	0	0	747	437	310	728	629	99	725

11	Guruvammapettai	284	1171	594	577	112	65	47	403	200	203	53	29	24	776	448	328	640	382	258	531
12	Janakipettai	152	640	323	317	70	27	43	572	283	289	0	0	0	386	238	148	334	38	296	306
13	Omipper	393	1741	873	868	189	94	95	547	261	286	0	0	0	1280	693	587	890	340	550	851
14	Adasal	284	1227	611	616	137	73	64	0	0	0	0	0	0	844	463	381	947	161	786	280
15	Palamukkal	179	852	426	426	87	47	40	505	257	248	15	5	10	517	297	220	414	406	8	438
16	Elavalapakkam	87	351	174	177	47	21	26	242	125	117	0	0	0	192	105	87	191	180	11	160
17	Jaggampettai	328	1411	703	708	139	75	64	911	447	464	0	0	0	977	504	473	743	682	61	668
18	Sorapattu	61	216	114	102	18	11	7	1	0	1	0	0	0	125	73	52	129	15	114	87
19	Peravur	637	2678	1383	1295	296	155	141	1394	716	678	4	2	2	1672	948	724	1444	1113	331	1234
20	Olagapuram	560	2481	1265	1216	268	134	134	1351	696	655	6	2	4	1449	839	610	1338	1309	29	1143
21	Kumalampattu	283	1274	663	611	144	83	61	494	252	242	31	18	13	739	448	291	769	716	53	505
22	Vengaram	82	331	172	159	33	18	15	243	127	116	0	0	0	189	115	74	192	23	169	139
23	Devanandal	113	465	243	222	58	29	29	308	161	147	0	0	0	293	167	126	318	314	4	147
24	T. Parangani	298	1277	638	639	154	80	74	301	146	155	94	45	49	690	415	275	695	380	315	582
	Total	**7243**	**30878**	**15542**	**15336**	**3259**	**1665**	**1594**	**13362**	**6738**	**6624**	**323**	**162**	**161**	**19161**	**10840**	**8321**	**16783**	**11528**	**5255**	**14095**
	G.Total	**13915**	**59454**	**29940**	**29514**	**6407**	**3248**	**3159**	**24866**	**12558**	**12308**	**953**	**456**	**497**	**36810**	**20887**	**15923**	**31086**	**22551**	**8535**	**28368**

Source: Village Wise Demographic Profile of the Study Area*, Census of India, 2011*

- ✓ Above table identifies the presence of villages and their subsequent population divided under three zones from plant boundary (i.e., Primary, secondary and tertiary zone)
- ✓ Primary zone has 7 villages where as much as 1397 households with 5908 population are located. Mostly lying on Built-up land for their livelihood and substance.
- ✓ Secondary and tertiary zone both comprise of 16 and 24villages having a total population of 22668 and 30878 respectively.

3.16 Gender and Sex Ratio

Sex ratio is used to describe the number of females per 1000 of males. Sex ratio is a valuable source for finding the population of women in India and what is the ratio of women to that of men in India. In the Population Census of 2011, it was revealed that the population ratio in India 2011 is 940 females per 1000 of males. The study area has 986 females per 1000 males. Gender and sex ratio determine the Human Development Index (HDI) of an area thereby understanding the status of women in that region. Census data suggests that the study area is composed of 50.36% of male and 49.64 % of female population. Following table entails information about sex ratio of 47 villages lying in study area (buffer zone) as primary, secondary and tertiary zone.

Table 3.16.1 Sex ratio of the study area

S. No.	Buffer Zone	Sex Ratio of Study area Female/ 1000 Male
1	Primary Zone (0-3 km)	989
2	Secondary zone (3-7 km)	984
3	Tertiary Zone (7-10 km)	987

Source: Census of India, 2011

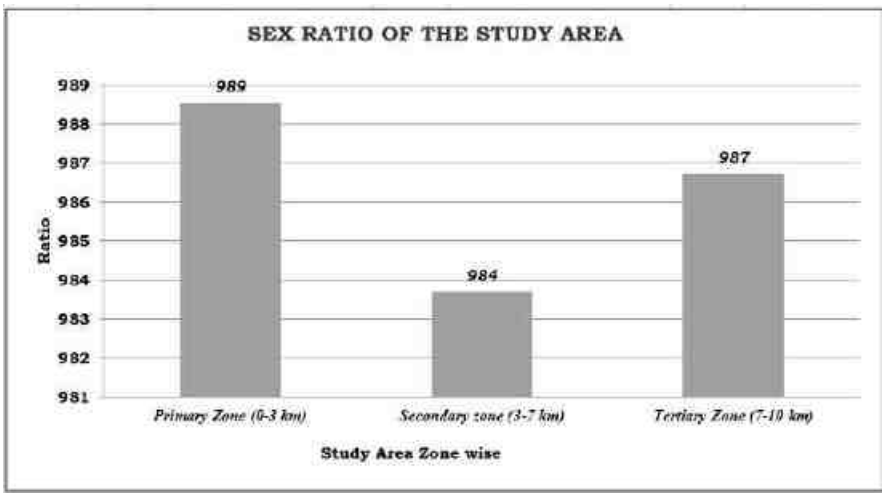


Figure 3.16.2 Sex Ratio within 10 Km study area

3.17 Literacy Rate in Study Area

Literacy Rate is the number of people in a place with the ability to read and write. The analysis of the literacy levels has been done in the study area. As per the 2011 Census of India, the male literacy rate, i.e., the percentage of literate males in the study area works out to be 78.35 %. Whereas the female literacy rate which is an important indicator for social change, is observed to be 60.42%. Female literacy rate in the region is coming out low as compared to male. This indicates that there is a need to focus in sociological aspect in the region and enhance further development. The distribution of literates and literacy rates in the surveyed villages is given below: (Table no 3.17.1).

Table 3.17.1 Literacy Rate of the Study Area

Zone	No. of Villages	Male Lite Population	Male literacy Rate	Female Literacy Population	Female literacy Rate	Total Literacy	Total Literacy Rate
Primary Zone (0 - 3 Km)	7	**1994**	75.56	**1484**	57.05	**3478**	66.37
Secondary Zone (3 - 7 Km)	16	**8053**	79.14	**6118**	61.11	**14171**	70.20
Tertiary Zone (7 - 10 Km)	24	**10840**	78.11	**8321**	60.55	**19161**	69.38
Study Area (0-10km)	**47**	**20887**	**78.25**	**15923**	**60.42**	**36810**	**69.39**

Source: Census of India, 2011

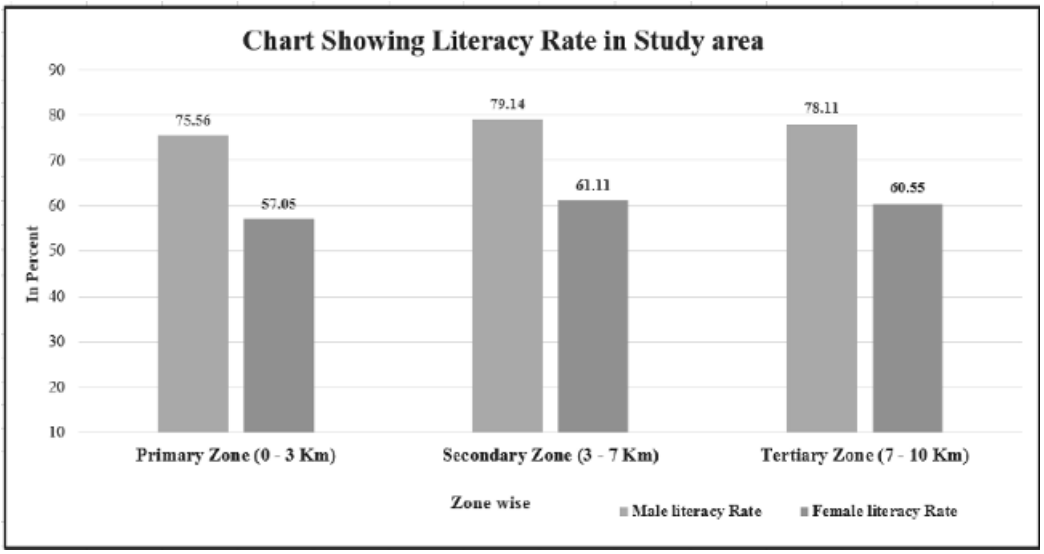


Figure 3.17.2 Gender wise Literacy Rate in the study area

3.18 Family Size

Size of family also describes about family functioning, resource consumption, total income generated and their expenditure pattern. Census 2011 data suggests that most of these households have a family size of up to 4 members, knowing the size of family also give fair understanding of relating how much resource consumption is being incurred, and annual income being generated and spent.

3.19 Vulnerable Group

While developing an action plan, it is very important to identify the population who fall under the marginalized and vulnerable groups and special attention has to be given towards these groups while making action plans. On the bases of data, it has been observed that the study area comprises of 41.82% Schedule Caste population and 1.60% of Schedule Tribe population. It is clearly show in below table that ST population is dominant than SC Population in the study area.

Table 3.19.1 vulnerable groups of the study area

Zone	No. of Villages	Vulnerable Groups					
		SC Population	%	ST Population	%	Other Population	%
Primary Zone (0 - 3 Km)	7	2849	48.22	66	1.12	2993	50.66
Secondary Zone (3 - 7 Km)	16	8655	38.18	564	2.49	13449	59.33
Tertiary Zone (7 - 10 Km)	24	13362	43.27	323	1.05	17193	55.68
Study Area (0-10km)	**47**	**24866**	**41.82**	**953**	**1.60**	**33635**	**56.57**

Source: Census of India, 2011

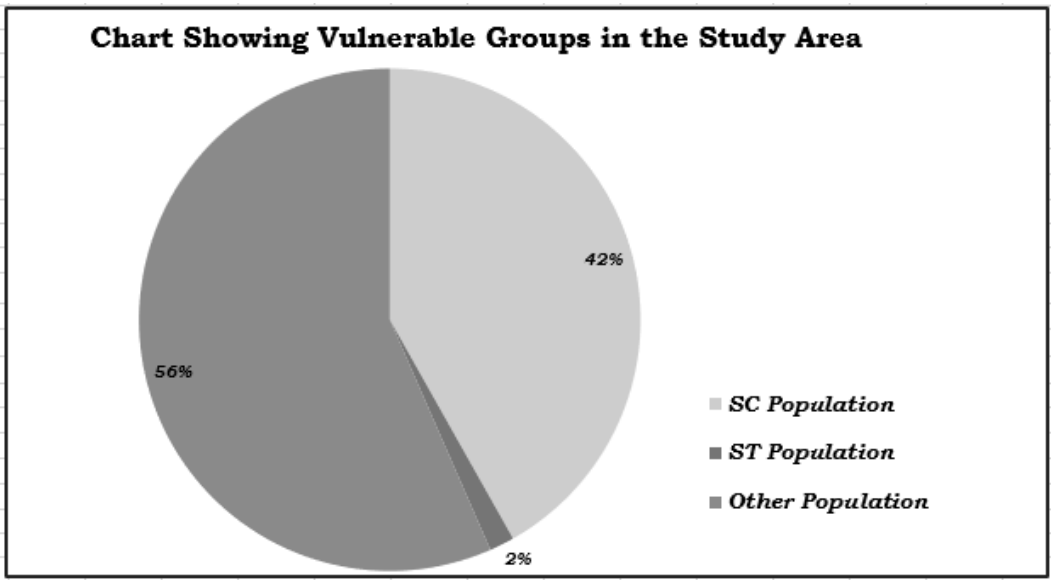


Figure 3.19.2 vulnerable groups

3.20 Economic Activities

The economy of an area is defined by the occupational pattern and income level of the people in the area. The occupational structure of residents in the study area is studied with reference to work category. The population is divided occupation wise into three categories, viz., main workers, marginal workers and non-workers. The workers include cultivators, agricultural laborers, those engaged in household industry and other services.

The marginal workers are those workers engaged in some work for a period of less than 180 days during the reference year. The non-workers include those engaged in unpaid household duties, students, retired persons, dependents, beggars, vagrants etc. besides institutional inmates or all other non-workers who do not fall under the above categories.

Table 3.20.1 shows the work force of the study area

Zone	No. of Villages	Total Workers	%	Main Workers	%	Marginal Workers	%	Non-Workers	%
Primary Zone (0 - 3 Km)	7	3013	51.00	2319	39.25	41	0.69	2895	49.00
Secondary Zone (3 - 7 Km)	16	11290	49.81	8704	38.40	2586	11.41	11378	50.19
Tertiary Zone (7 - 10 Km)	24	16783	54.35	11528	37.33	5255	17.02	14095	45.65
Study Area (10 Km)	**47**	**31086**	52.29	**22551**	**37.93**	**7882**	**13.26**	**28368**	**47.71**

Source: Census of India, 2011

The above table shows that out of the total working population, the percentage of main workers is 37.93 % while 13.26% are marginal workers. Number of working populations is 52.29% and non-working population is 47.71% in the study area. As per the data obtained from the survey (as mentioned previously in occupational structure) most of these people are employed for major period of the year. Also, to mention the natural environment also restricts the people in finding stable business is performed for only certain months. Thus, proposed project will act as possible exposure for them to get enroll and earn sustain livelihood.

As per the villages analysis most of them are non-working population. A major portion of working age people is not ideal worker because of limited sectors in which they are engaged with less training and not awareness of latest sectors in which maybe they can better other than traditional work.

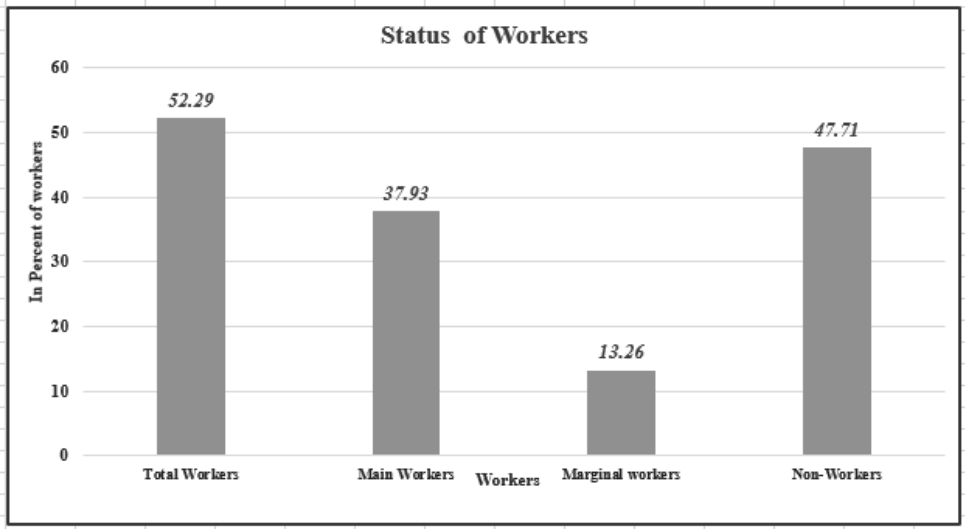


Figure 3.20.2. Working population in the study area

3.21 Basic Amenities

A better network of physical infrastructure facilities (well-built roads, rail links, irrigation, power and telecommunication, information technology, market-network and social infrastructure support, viz. health and education, water and sanitation, veterinary services and co-operatives) is essential for the development of the rural economy. A review of infrastructure

facilities available in the area has been done based on the information from baseline survey of the study area. In this review, the villages which fall within 10Km radius round the site has been considered. Infrastructure facilities available in the area have been described in the subsequent sections as below:

1. Educational Facilities

Education is considered to be one of the most dominant indicators towards the development of a region. According to baseline survey, education facilities are available in the villages within the study area. All the villages have schools only up to primary and middle level, higher level education facilities very less only one-degree college available in Tindivanam Taluk. Improved educational facilities will be provided by CCIL, which will contribute Improvement in awareness level of the villagers.

2. Health Facilities

Medical facilities are available. There are majorly non-Government medical facilities/medicine shop available in the area. There is only one dispensary / health center available and no Primary Health Sub-Centers available in the study area. There is no such case of epidemic or some special diseases in the region. Normal cases of diseases i.e. Cough, cold, fever, headache etc. are reported in the region.

3. Other Infrastructure Facilities

Basic facilities are available in study area as educational facilities, health, transportation, electricity, drinking water, market, bank, post office, petrol pump; Aanganbadi Centers, Community Hall, Cooperative bank and Commercial Bank etc. are available.

- **Transport Facilities**

The study area is served by road transport. Most of the villages connected by bus/other transport services. The area has a moderate road network, which includes state highway, major District Roads and other roads within 10 km radius of the plant boundary. Major District Road is passing through the adjacent of Quarry area.

- **Electrification in the Area**

100% villages in the study area are electrified. Electricity is available for domestic, commercial, industrial agricultural and public lighting purposes.

- **Drinking Water Facility**

Village people are availing Drinking water facilities generally from Tap water, Pond, Well, Tube well, Hand Pump, River etc. In few villages like Sendamangalam,Tennampundi, Endur, Nerkunam, Panaiyur Villages etc. there is problem of drinking water facility.

3.22 Interpretation

Based on the data, following inferences could be drawn:

- Total literacy rate in the study area is 69%.
- The study area had average educational facilities. The overall status depicts that the education is limited to primary and middle level.
- The schedule tribe community forms 1.6% and Scheduled Caste forms 42% of the total population of study area.
- The Other Population forms 56.57% of the total population of study area.
- The study area is well connected by District/Village Road.
- The study area not well health facilities of primary level.

- Considering the above facts, the proposed project will boost the socio-economic development activities in the area and hence will leave positive impact.
- The study area has mobile connectivity

3.23 Recommendations and Suggestion

- Education Awareness program is being/will be conducted to make the population aware and better treatment for livelihood.
- Vocational training session is being/will be organized to provide self-employment to the women and unemployment youth.
- Healthcare Centre and Ambulance facility is being/will be provided to make the population get easy medical facilities.
- Natural Resource Management and Environmental Conservation.
- On the basis of qualification and skills local youths is being/will be employed. Long term and short-term employments is being/will be generated.
- Health care center and ambulance facility is being/will be provided to make the population get easy medical facilities.
- Basic amenities and facilities are being/will be made available to the people and there will be proper maintenance of the facilities already provided by the government in the study area through various CSR activities conducted by Tirupati Blue metals,

3.24 CONCLUSION

To evaluate the impacts of proposed rough stone and gravel quarry project on the surrounding area, it is vital to assess the baseline status of the environmental quality in the locality of the site. Socio-Economic Survey was also conducted during the study period which revealed that area further require improvement in the Economy and Infrastructure Development of the area. Hence it can be concluded that the present baseline environment status of the study area will not be affected by the proposed project as **Tirupati Blue metals**, will adopt adequate control measures to protect the surrounding environment and will contribute in development of the study areas.

The proposed project will aim to provide preferential employment to the local people there by improving the employment opportunity in the area and in turn the social standards will improve.

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.0 GENERAL

Environmental impacts both direct and indirect on various environmental attributes due to proposed mining activity will be created in the surrounding environment, during the operational and post–operational phases. The occurrence of mineral deposits, being site specific, their exploitation, often, does not allow for any choice except adoption of eco-friendly operation. The methods are required to be selected in such a manner, so as to maintain environmental equilibrium ensuring sustainable development.

In order to maintain the environmental commensuration with the mining operation, it is essential to undertake studies on the existing environmental scenario and assess the impact on different environmental components. This would help in formulating suitable management plans sustainable resource extraction.

Several scientific techniques and methodologies are available to predict impacts of physical environment. Mathematical models are the best tools to quantitatively describe the cause-and-effect relationships between sources of pollution and different components of environment. In cases where it is not possible to identify and validate a model for a particular situation, predictions have been arrived at based on logical reasoning / consultation / extrapolation.

The following parameters are of significance in the Environmental Impact Assessment and are being discussed in detail

- Land environment
- Soil environment
- Water Environment
- Air Environment
- Noise Environment
- Socio economic environment
- Biological Environment

Based on the baseline environmental status at the project site, the environmental factors that are likely to be affected (Impacts) are identified, quantified and assessed.

4.1 LAND ENVIRONMENT:

4.1.2 Anticipated Impact of Proposed Projects

- Permanent or temporary change on land use and land cover.
- Change in Topography: Topography of the ML area will change at the end of the life of the mine.
- Movement of heavy vehicles sometimes cause problems to agricultural land, human habitations due to dust, noise and it also causes traffic hazards.
- Due to degradation of land by pitting the aesthetic environment of the core zone may be affected.
- Earthworks during the rainy season increase the potential for soil erosion and sediment laden water entering the water ways.

If no due care is taken wash off from the exposed working area may choke the water course & can also causes the siltation of water course

4.1.2 Common Mitigation Measures for Proposed Projects

- The mining activity will be gradual confined in blocks and excavation will be undertaken progressively along with other mitigative measures like phase wise development of greenbelt etc.
- Construction of garland drains all around the quarry pits and construction of check dam at strategic location in lower elevations to prevent erosion due to surface runoff during rainfall and also to collect the storm water for various uses within the proposed area.
- Green belt development along the boundary within safety zone. The small quantity of water stored in the mined-out pit will be used for greenbelt.
- Thick plantation will be carried out on unutilized area, top benches of mined out pits, on safety barrier, etc.,
- At conceptual stage, the land use pattern of the quarry will be changed into Greenbelt area and temporary reservoir
- In terms of aesthetics, natural vegetation surrounding the quarry will be retained (such as in a buffer area i.e., 7.5 m safety barrier and other safety provided) so as to help minimise dust emissions.
- Proper fencing will be carried out at the conceptual stage, Security will be posted round the clock, to prevent inherent entry of the public and cattle.

4.1.3 Soil Environment

The proposed projects area is covered by thin layer of Gravel formation and the average thickness is about 2 m, there is no Gravel excavation during the mining plan period.

4.1.4 Impact on Soil Environment from Proposed Projects

Erosion and Sedimentation (Removal of protective vegetation cover; Exposure of underlying soil horizons that may be less pervious, or more erodible than the surface layers; Reduced capacity of soils to absorb rainfall; Increased energy in storm-water runoff due to concentration and velocity; and Exposure of subsurface materials which are unsuitable for vegetation establishment).

4.1.5 Common Mitigation Measures for Proposed Projects

- Run-off diversion – Garland drains will be constructed all around the project boundary to prevent surface flows from entering the quarry works areas. And will be discharged into vegetated natural drainage lines, or as distributed flow across an area stabilised against erosion.
- Sedimentation ponds - Run-off from working areas will be routed towards sedimentation ponds. These trap sediment and reduce suspended sediment loads before runoff is discharged from the quarry site. Sedimentation ponds should be designed based on runoff, retention times, and soil characteristics. There may be a need to provide a series of sedimentation ponds to achieve the desired outcome.
- Retain vegetation – Retain existing or re-plant the vegetation at the site wherever possible.
- Monitoring and maintenance – Weekly monitoring and daily maintenance of erosion control systems so that they perform as specified specially during rainy season.

4.1.6 Waste Dump Management

There is no waste anticipated in this Rough Stone quarrying operation. The entire quarried out materials will be utilized (100%).

4.2 WATER ENVIRONMENT

4.2.1 Anticipated Impact from Proposed Project

- The major sources of water pollution normally associated due to mining and allied operations are:
    - Generation of waste water from vehicle washing.
    - Washouts from surface exposure or working areas
    - Domestic sewage
    - Disturbance to drainage course in the project area
    - Mine Pit water discharge

- Increase in sediment load during monsoon in downstream of lease area
- This being a mining project, there will be no process effluent. Waste from washing of machinery may result in discharge of Oil & grease, suspended solids.
- The sewage from soak pit may percolate to the ground water table and contaminate it.
- Surface drainage may be affected due to Mining
- Abstraction of water may lead to depletion of water table

Detail of water requirements in KLD as given below:

TABLE 4.1: WATER REQUIREMENT

PROPOSAL – P1		
*Purpose	Quantity	Source
Dust Suppression	0.6 KLD	From Existing bore wells from nearby area
Green Belt development	0.5 KLD	From Existing bore wells from nearby area
Domestic purpose	0.4 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors
Total	**1.5 KLD**	
PROPOSAL – P2		
*Purpose	Quantity	Source
Dust Suppression	3.0 KLD	From Existing bore wells from nearby area
Green Belt development	0.4 KLD	From Existing bore wells from nearby area
Domestic purpose	0.6 KLD	From existing, bore wells and drinking water will be sourced from Approved water vendors
Total	**4.0 KLD**	

* Water for drinking purpose will be brought from approved water vendors
Source: Approved Mining Plan Pre-Feasibility Report

4.2.2 Common Mitigation Measures for Individual Proposed Projects

- Garland drain, settling tank will be constructed along the proposed mining lease area. The Garland drain will be connected to settling tank and sediments will be trapped in the settling traps and only clear water will be discharged out to the natural drainage
- Rainwater will be collected in sump in the mining pits and will be allowed to store and pumped out to surface setting tank of 15 m x 10m x 3m to remove suspended solids if any. This collected water will be judiciously used for dust suppression and such sites where dust likely to be generated and for developing green belt. The proponent will collect and judicially utilize the rainwater as part of rainwater harvesting system.
- Providing benches with inner slopes and through a system of drains and channels, allowing rain water to descent into surrounding drains, so as to minimize the effects of erosion & water logging arising out of uncontrolled descent of water.
- Reuse the water collected during storm for dust suppression and greenbelt development within the mines
- Installing interceptor traps/oil separators to remove oils and greases. Water from the tipper wash-down facility and machinery maintenance yard will pass through interceptor traps/oil separators prior to its reuse;
- Using flocculating or coagulating agents to assist in the settling of suspended solids during monsoon seasons;
- Periodic (every 6 month once) analysis of quarry pit water and ground water quality in nearby villages.
- Domestic sewage from site office & urinals/latrines provided in ML is discharged in septic tank followed by soak pits.
- Waste water discharge from mine will be treated in settling tanks before using for dust suppression and tree plantation purposes.
- De-silting will be carried out before and immediately after the monsoon season.
- Regular monitoring (every 6 month once) and analysing the quality of water in open well, bore wells and surface water

4.3 AIR ENVIRONMENT

4.3.1. Anticipated Impact from Proposed Projects

- During mining, at various stages activities such as excavation, drilling, blasting, and transportation of materials, particular matter (PM), gases such as Sulphur dioxide, oxides of Nitrogen from vehicular exhaust are the main air pollutants.
- Emissions of noxious gases due to incomplete detonation of explosive may sometimes pollute the air.
- The fugitive dust released from the mining operations may cause effect on the mine workers who are directly exposed to the fugitive dust.
- Simultaneously, the air-borne dust may travel to longer distances and settle in the villages located near the mine lease area.

4.3.1.1. Modelling of Incremental Concentration from Proposed Projects

Wind erosion of the exposed areas and the air borne particulate matter generated by quarrying operation, and transportation are mainly PM_{10} & $PM_{2.5}$ and emissions of Sulphur dioxide (SO_2) & Oxides of Nitrogen (NOx) due to excavation/loading equipment and vehicles plying on haul roads are the cause of air pollution in the project area.

Similarly, loading - unloading and transportation of Rough Stone, wind erosion of the exposed area and movement of light vehicles causes of pollution. This leads to an impact on the ambient air environment around the project area.

Anticipated incremental concentration due to this quarrying activity and net increase in emissions due to quarrying activities within 500 meters around the project area is predicted by Open Pit Source modelling using

AERMOD Software.

The impact on Air Environment is due to the mining and allied activities during Land Development phase, Mining process and Transportation. The emissions of Sulphur dioxide (SO_2), Oxides of Nitrogen (NOx) due to excavation/loading equipment and vehicles plying on haul roads are marginal. Loading - unloading and transportation of Rough Stone, wind erosion of the exposed area and movement of light vehicles will be the main polluting source in the mining activities releasing Particulate Matter (PM_{10}) affecting Ambient Air of the area. Prediction of impacts on air environment has been carried out taking into consideration cumulative production three proposed quarries. Air environment and net increase in emissions by Open pit source modelling in AERMOD Software.

4.3.2.1 Emission Estimation

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.

The general equation for emissions estimation is:

$$E = A \times EF \times (1-ER/100)$$

Where:

E = emissions;

A = activity rate;

EF = emission factor, and

ER =overall emission reduction efficiency, %

The proposed mining activity includes various activities like ground preparation, excavation, handling and transport of Rough Stone. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 4-2.

4.3.2 Frame work of Computation & Model details

By using the above-mentioned inputs, ground level concentrations due to the quarrying activities have been estimated to know the incremental concentration in ambient air quality and impact in the study area. The effect of air pollutants upon receptors are influenced by concentration of pollutants and their dispersion in the atmosphere. Air quality

modelling is an important tool for prediction, planning and evaluation of air pollution control activities besides identifying the requirements for emission control to meet the regulatory standards and to apply mitigation measures to reduce impact caused by quarrying activities. Suspended Particulate Matter (SPM) is the major pollutant occurred during quarrying activities. The prediction included the impact of Excavation, Drilling, Blasting (Occasionally), loading and movement of vehicles during transportation and meteorological parameters such as wind speed, wind direction, temperature, rainfall, humidity and Cloud cover.

Impact was predicted over the distance of 10 km around the source to assess the impact at each receptor separately at the various locations and maximum incremental GLC value at the project site. Maximum impact of PM10 was observed close to the source due to low to moderate wind speeds. Incremental value of PM10 was superimposed on the base line data monitored at the proposed site to predict total GLC of PM10 due to combined impacts

TABLE 4.2: ESTIMATED EMISSION RATE FOR PM_{10}

Activity	Source type	Value		Unit
		P1	P2	
Drilling	Point Source	0.090953573	0.134694600	g/s
Blasting	Point Source	0.001505613	0.010724212	g/s
Mineral Loading	Point Source	0.043260263	0.049349650	g/s
Haul Road	Line Source	0.002494166	0.002526968	g/s
Overall Mine	Area Source	0.060538878	0.102645565	g/s

TABLE 4.3: ESTIMATED EMISSION RATE FOR SO_2

Activity	Source type	Value		Unit
		P1	P2	
Overall Mine	Area Source	0.000835903	0.003197641	g/s

TABLE 4.4: ESTIMATED EMISSION RATE FOR NO_X

Activity	Source type	Value		Unit
		P1	P2	
Overall Mine	Area Source	0.000052590	0.000550162	g/s

FIGURE 4.1: AERMOD TERRAIN MAP

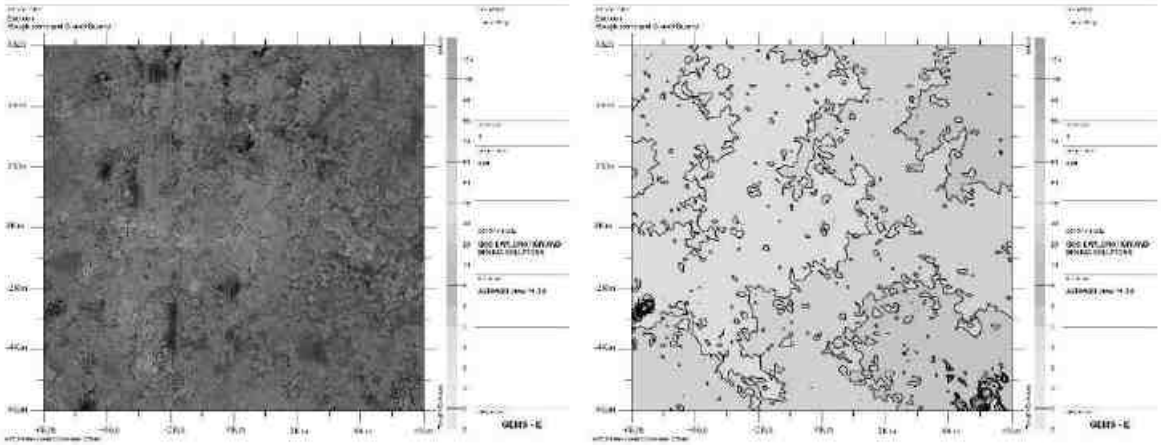


FIGURE 4.2: PREDICTED INCREMENTAL CONCENTRATION OF PM_{10}

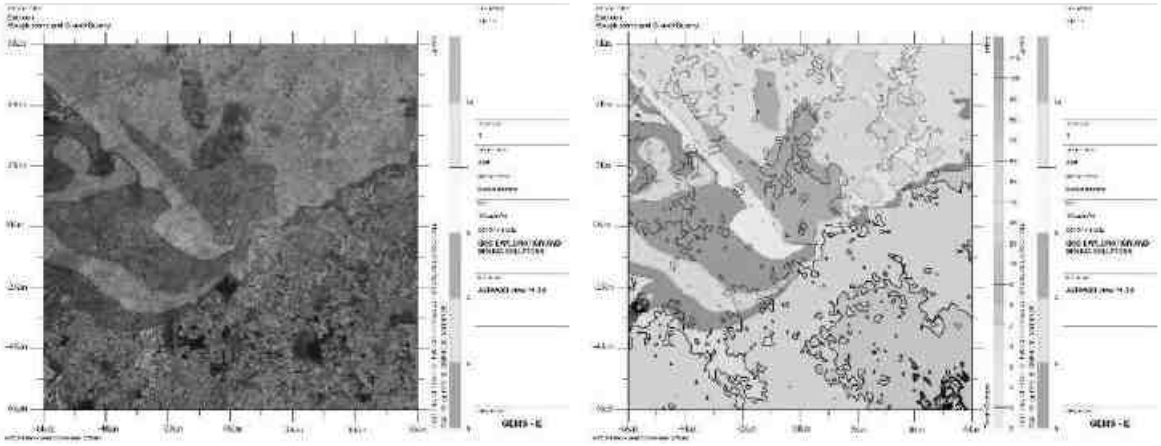


FIGURE 4.3: PREDICTED INCREMENTAL CONCENTRATION OF $PM_{2.5}$

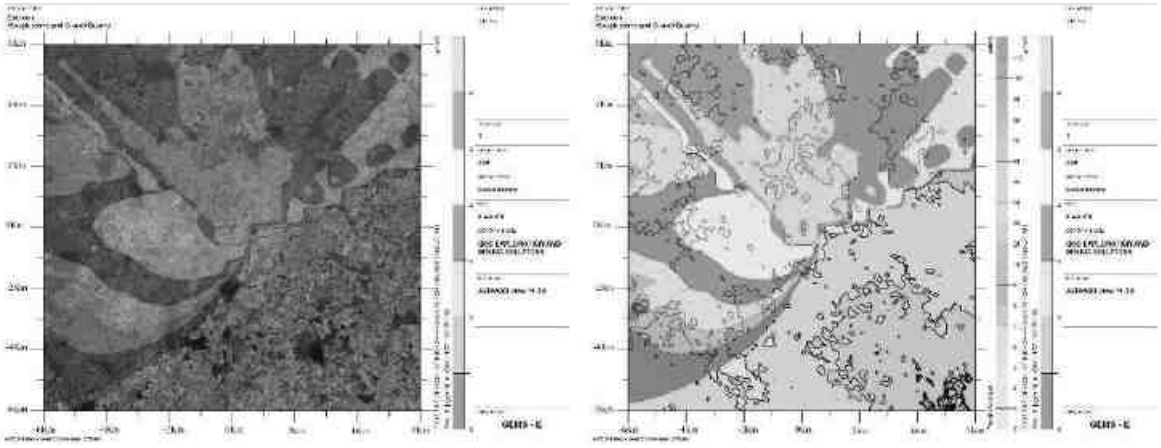


FIGURE 4.4: PREDICTED INCREMENTAL CONCENTRATION OF SO_2

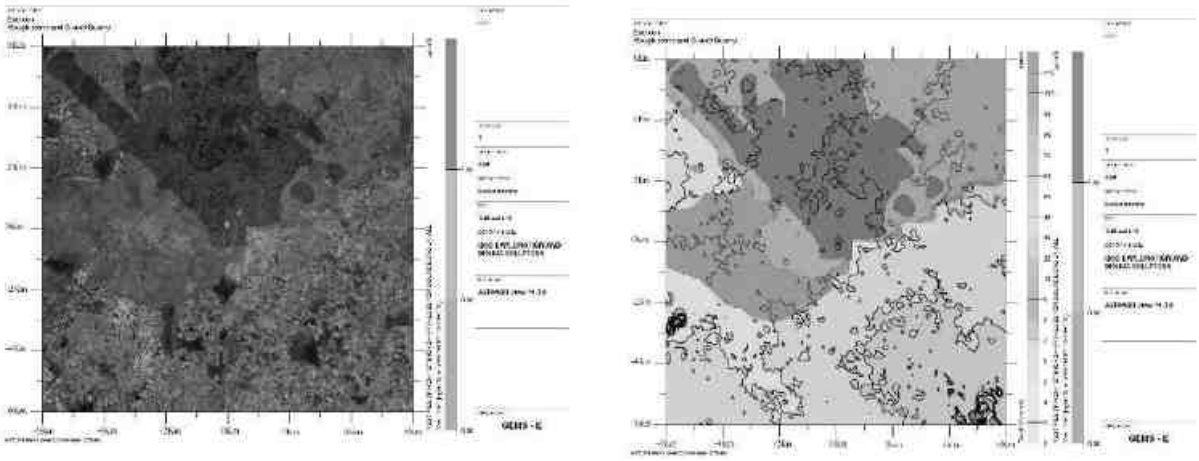


FIGURE 4.5: PREDICTED INCREMENTAL CONCENTRATION OF NO_X

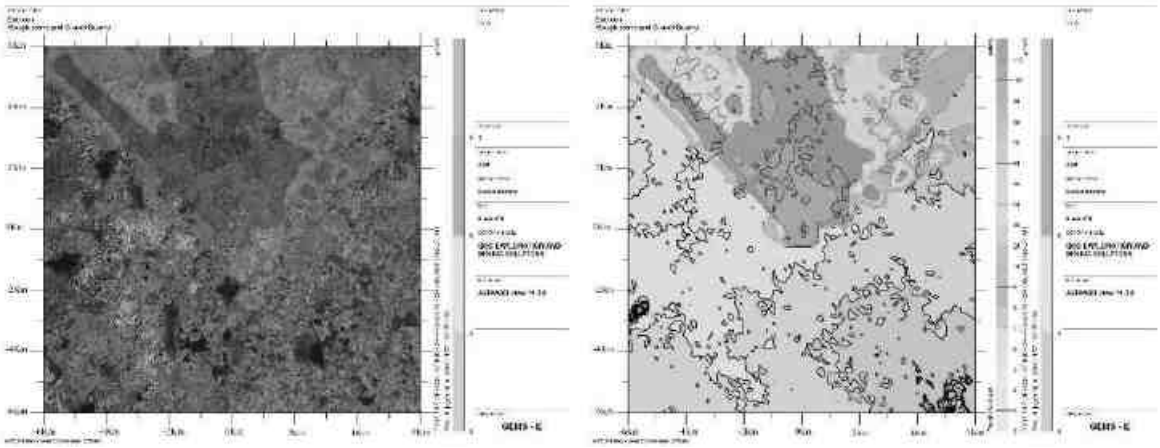
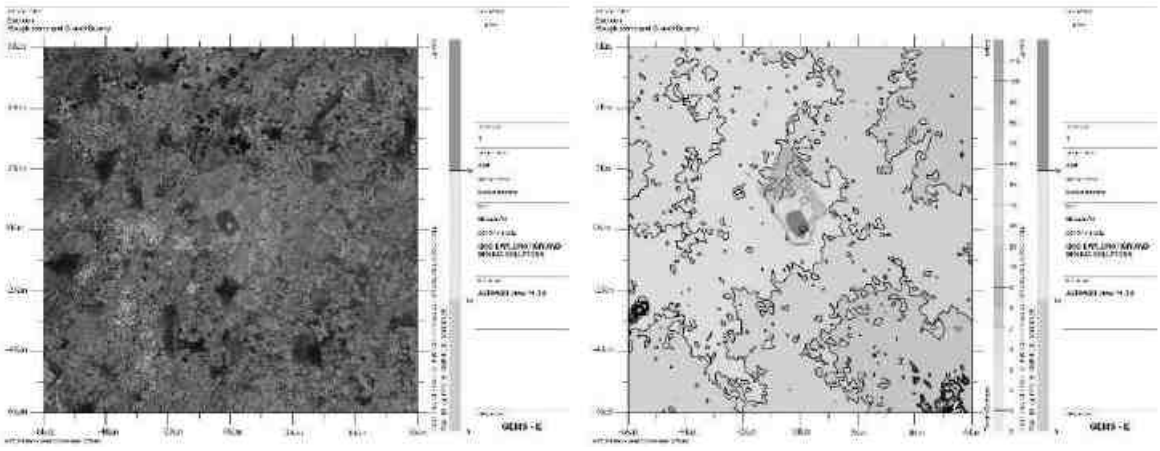


FIGURE 4.6: PREDICTED INCREMENTAL CONCENTRATION OF FUGITIVE DUST



4.3.2.1 Model Results

The post project Resultant Concentrations of PM10, PM2.5, SO2 & NOX (GLC) is given in Table below:

TABLE 4.5: INCREMENTAL & RESULTANT GLC OF PM_{10}

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline PM_{10} ($\mu g/m^3$)	Incremental value of PM_{10} due to mining ($\mu g/m^3$)	Total PM_{10} ($\mu g/m^3$) (5+6)
AAQ1	12°13'20.40"N 79°47'15.20"E	-32	-113	42.4	14.80	57.2
AAQ2	12°13'32.90"N 79°47'28.95"E	386	272	42.4	14.21	56.61
AAQ3	12°14'35.43"N 79°45'23.51"E	-3421	2198	37.5	4.10	41.6
AAQ4	12°14'6.23"N 79°49'4.15"E	3276	1297	37.0	9.85	46.85
AAQ5	12°11'57.61"N 79°46'37.14"E	-1186	-2663	45.4	0.57	45.97
AAQ6	12°12'53.65"N 79°44'52.20"E	-4371	-937	45.0	6.00	51.00
AAQ7	12°15'42.01"N 79°48'16.56"E	1829	4254	45.9	13.33	59.23
AAQ8	12°12'0.14"N 79°48'37.05"E	2454	-2588	43.6	0	43.6

TABLE 4.6: INCREMENTAL & RESULTANT GLC OF PM2.5

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline $PM_{2.5}$ ($\mu g/m^3$)	Incremental value of $PM_{2.5}$ due to mining ($\mu g/m^3$)	Total $PM_{2.5}$ ($\mu g/m^3$) (5+6)
AAQ1	12°13'20.40"N 79°47'15.20"E	-32	-113	22.3	6.89	29.19
AAQ2	12°13'32.90"N 79°47'28.95"E	386	272	21.9	6.34	28.24
AAQ3	12°14'35.43"N 79°45'23.51"E	-3421	2198	22.0	2.75	24.75
AAQ4	12°14'6.23"N 79°49'4.15"E	3276	1297	22.2	4.68	26.88
AAQ5	12°11'57.61"N 79°46'37.14"E	-1186	-2663	22.2	1.73	23.93
AAQ6	12°12'53.65"N 79°44'52.20"E	-4371	-937	22.3	3.50	25.8
AAQ7	12°15'42.01"N 79°48'16.56"E	1829	4254	22.4	5.61	28.01
AAQ8	12°12'0.14"N 79°48'37.05"E	2454	-2588	22.1	0	22.1

TABLE 4.7: INCREMENTAL & RESULTANT GLC OF SO_2

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline So_2 ($\mu g/m^3$)	Incremental value of So_2 due to mining ($\mu g/m^3$)	Total So_2 ($\mu g/m^3$) (5+6)
AAQ1	12°13'20.40"N 79°47'15.20"E	-32	-113	6.7	1.87	8.57
AAQ2	12°13'32.90"N 79°47'28.95"E	386	272	6.6	1.80	8.40
AAQ3	12°14'35.43"N 79°45'23.51"E	-3421	2198	6.2	0.24	6.44
AAQ4	12°14'6.23"N 79°49'4.15"E	3276	1297	5.8	1.02	6.82
AAQ5	12°11'57.61"N 79°46'37.14"E	-1186	-2663	7.2	0	7.2
AAQ6	12°12'53.65"N 79°44'52.20"E	-4371	-937	6.8	0.70	7.5
AAQ7	12°15'42.01"N 79°48'16.56"E	1829	4254	6.8	1.55	8.35
AAQ8	12°12'0.14"N 79°48'37.05"E	2454	-2588	6.8	0	6.8

TABLE 4.8: INCREMENTAL & RESULTANT GLC OF NO_X

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Nox ($\mu g/m^3$)	Incremental value of Nox due to mining ($\mu g/m^3$)	Total Nox ($\mu g/m^3$) (5+6)
AAQ1	12°13'20.40"N 79°47'15.20"E	-32	-113	24.1	9.73	33.83
AAQ2	12°13'32.90"N 79°47'28.95"E	386	272	24.0	9.11	33.11
AAQ3	12°14'35.43"N 79°45'23.51"E	-3421	2198	24.3	0	24.3
AAQ4	12°14'6.23"N 79°49'4.15"E	3276	1297	24.1	2.00	26.1
AAQ5	12°11'57.61"N 79°46'37.14"E	-1186	-2663	23.8	0	23.8
AAQ6	12°12'53.65"N 79°44'52.20"E	-4371	-937	24.3	0	24.3

AAQ7	12°15'42.01"N 79°48'16.56"E	1829	4254	24.3	4.70	29.0
AAQ8	12°12'0.14"N 79°48'37.05"E	2454	-2588	24.2	0	24.2

TABLE 4.9: INCREMENTAL & RESULTANT GLC OF FUGITIVE DUST

Station Code	Location	X Coordinate (m)	Y Coordinate (m)	Average Baseline Fugitive (µg/m^3)	Incremental value of Fugitive due to mining (µg/m^3)	Total Fugitive (µg/m^3) (5+6)
AAQ1	10°53'33.77"N 77° 4'25.54"E	-32	-113	64.55	88	152.55
AAQ2	10°53'30.54"N 77° 5'49.75"E	386	272	64.52	39	103.52
AAQ3	10°54'53.37"N 77° 2'49.30"E	-3421	2198	63.31	0	63.31
AAQ4	10°54'3.88"N 77° 1'49.87"E	3276	1297	64.08	0	64.08
AAQ5	10°55'44.74"N 77° 5'4.27"E	-1186	-2663	65.75	0	65.75
AAQ6	10°53'11.03"N 77° 3'34.57"E	-4371	-937	65.75	0	65.75
AAQ7	10°55'24.72"N 77° 6'28.31"E	1829	4254	63.35	0	63.35
AAQ8	10°52'19.32"N 77° 3'43.42"E	2454	-2588	57.38	0	57.38

From the resultant of cumulative concentration i.e., Background + Incremental Concentration of pollutant in all the receptor locations without effective mitigation measures are still within the prescribed NAAQ limits of 100, 80 & 80 µg/m3 for PM10, SO2 & NOX respectively. By adopting suitable mitigation measures, the pollutant levels in the atmosphere can be further being controlled.

4.3.4. Common Mitigation Measures for Proposed Project

Drilling – To control dust at source, wet drilling will be practiced. Where there is a scarcity of water, suitably designed dust extractor will be provided for dry drilling along with dust hood at the mouth of the drill-hole collar.

Advantages of Wet Drilling: -

- In this system dust gets suppressed close to its formation. Dust suppression become very effective and the work environment will be improved from the point of occupational comfort and health.
- Due to dust free atmosphere, the life of engine, compressor etc., will be increased.
- The life of drill bit will be increased.
- The rate of penetration of drill will be increased.
- Due to the dust free atmosphere visibility will be improved resulting in safer working conditions.

Blasting –

- Establish time of blasting to suit the local conditions and water sprinkling on blasting face
- Avoid blasting i.e., when temperature inversion is likely to occur and strong wind blows towards residential areas
- Controlled blasting includes Adoption of suitable explosive charge and short delay detonators, adequate stemming of holes at collar zone and restricting blasting to a particular time of the day i.e. at the time lunch hours, controlled charge per hole as well as charge per round of hole
- Before loading of material water will be sprayed on blasted material
- Dust mask will be provided to the workers and their use will be strictly monitored

Haul Road & Transportation –

- Water will be sprinkled on haul roads twice a day to avoid dust generation during transportation
- Transportation of material will be carried out during day time and material will be covered with taurpaulin
- The speed of tippers plying on the haul road will be limited below 20 km/hr to avoid generation of dust.
- Water sprinkling on haul roads & loading points will be carried out twice a day
- Main source of gaseous pollution will be from vehicle used for transportation of mineral; therefore, weekly maintenance of machines improves combustion process & makes reduction in the pollution.
- The un-metaled haul roads will be compacted weekly before being put into use.
- Over loading of tippers will be avoided to prevent spillage.

- It will be ensured that all transportation vehicles carry a valid PUC certificate
- Grading of haul roads and service roads to clear accumulation of loose materials

Green Belt –

- Planting of trees all along main mine haul roads and regular grading of haul roads will be practiced to prevent the generation of dust due to movement of dumpers/trucks
- Green belt of adequate width will be developed around the project areas

Occupational Health –

- Dust mask will be provided to the workers and their use will be strictly monitored
- Annual medical checkups, trainings and campaigns will be arranged to ensure awareness about importance of wearing dust masks among all mine workers & tipper drivers
- Ambient Air Quality Monitoring will be conducted six months once to assess effectiveness of mitigation measures proposed

4.4 NOISE ENVIRONMENT

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. These activities will not cause any problem to the inhabitants of this area because there is no human settlement in close proximity to the project area. Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities.

Predictions have been carried out to compute the noise level at various distances around the working pit due to these major noise-generating sources. Noise modelling has been carried out to assess the impact on surrounding ambient noise levels.

Basic phenomenon of the model is the geometric attenuation of sound. Noise at a point generates spherical waves, which are propagated outwards from the source through the air at a speed of 1,100 ft/sec, with the first wave making an ever-increasing sphere with time. As the wave spreads the intensity of noise diminishes as the fixed amount of energy is spread over an increasing surface area of the sphere. The assumption of the model is based on point source relationship i.e., for every doubling of the distance the noise levels are decreased by 6 dB (A).

For hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations at different sources using model based on first principle.

$$Lp_2 = Lp_1 - 20 \log (r_2/r_1) - Ae_{1,2}$$

Where:

Lp_1 & Lp_2 are sound levels at points located at distances r_1 & r_2 from the source.

$Ae_{1,2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$$Lp_{total} = 10 \log \{10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} + \ldots\ldots\}$$

4.4.1 Anticipated Impact from Proposed Project

Attenuation due to Green Belt has been taken to be 4.9 dB (A). The inputs required for the model are:

- Source data
- Receptor data
- Attenuation factor

Source data has been computed taking into account of all the machinery and activities used in the mining process. Same has been listed in Table 4-8.

TABLE 4.10: ACTIVITY AND NOISE LEVEL PRODUCED BY MACHINERY

Sl.No.	Machinery / Activity	Impact on Environment?	Noise Produced in dB(A) at 50 ft from source*
1	Blasting	Yes	94
2	Jack Hammer	Yes	88
3	Compressor	No	81
4	Excavator	No	85

5	Tipper	No	84
Total Noise Produced			95.8

*50 feet from source = 15.24 meters

Source: U.S. Department of Transportation (Federal Highway Administration) – Construction Noise Handbook

The total noise to be produced by mining activity is calculated to be 95.8 dB (A). Generally, most mining operations produce noise between 100-109 dB (A). We have considered equipment and operation noise levels (max) to be approx. 109 dB (A) for nose prediction modelling.

TABLE 4.11: PREDICTED NOISE INCREMENTAL VALUES

Location ID	N1	N2	N3	N4	N5	N6	N7	N8
Maximum Monitored Value (Day) dB(A)	41.7	40.7	39.1	39.9	40.5	40.8	39.4	36.8
Incremental Value dB(A)	54.1	52.1	32.7	29.9	31.9	27.3	28.7	29.5
Total Predicted Noise level dB(A)	54.3	52.4	40.0	40.3	41.1	41.0	39.8	37.5

The incremental noise level is found within the range of 52.1 – 54.1 dB (A) in Core Zone and 32.7 – 27.3 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A) the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations are within permissible limits of Industrial area (core zone) & Residential area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986).

4.4.2 Common Mitigation Measures for Proposed Project

The following noise mitigation measures are proposed for control of Noise

- Usage of sharp drill bits while drilling which will help in reducing noise;
- Secondary blasting will be totally avoided and hydraulic rock breaker will be used for breaking boulders;
- Controlled blasting with proper spacing, burden, stemming and optimum charge/delay will be maintained;
- The blasting will be carried out during favourable atmospheric condition and less human activity timings by using nonelectrical initiation system;
- Proper maintenance, oiling and greasing of machines will be done every week to reduce generation of noise;
- Provision of sound insulated chambers for the workers working on machines (HEMM) producing higher levels of noise;
- Silencers / mufflers will be installed in all machineries;
- Green Belt/Plantation will be developed around the project area and along the haul roads. The plantation minimizes propagation of noise;
- Personal Protective Equipment (PPE) like ear muffs/ear plugs will be provided to the operators of HEMM and persons working near HEMM and their use will be ensured though training and awareness.
- Regular medical check–up and proper training to personnel to create awareness about adverse noise level effects

4.4.3 Ground Vibrations

Ground vibrations due to the proposed mining activities are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc., However, the major source of ground vibration from the quarry is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining lease area and may cause injury to persons or damage to the structures. Nearest habitation from the proposed project areas are listed in below table. The ground vibrations due to the blasting in the quarry are calculated using the empirical equation.

The empirical equation for assessment of peak particle velocity (PPV) is:

$$V = K [R/Q^{0.5}]^{-B}$$

Where –
V = peak particle velocity (mm/s)
K = site and rock factor constant
Q = maximum instantaneous charge (kg)
B = constant related to the rock and site (usually 1.6)
R = distance from charge (m)

TABLE 4.12: PREDICTED PPV VALUES DUE TO BLASTING

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	75	5700m – SW	0.616
Location ID	**Maximum Charge in kgs**	**Nearest Habitation in m**	**PPV in m/ms**
P2	333	800m – SW	1.180

FIGURE 4.7: GROUND VIBRATION PREDICTION-P1

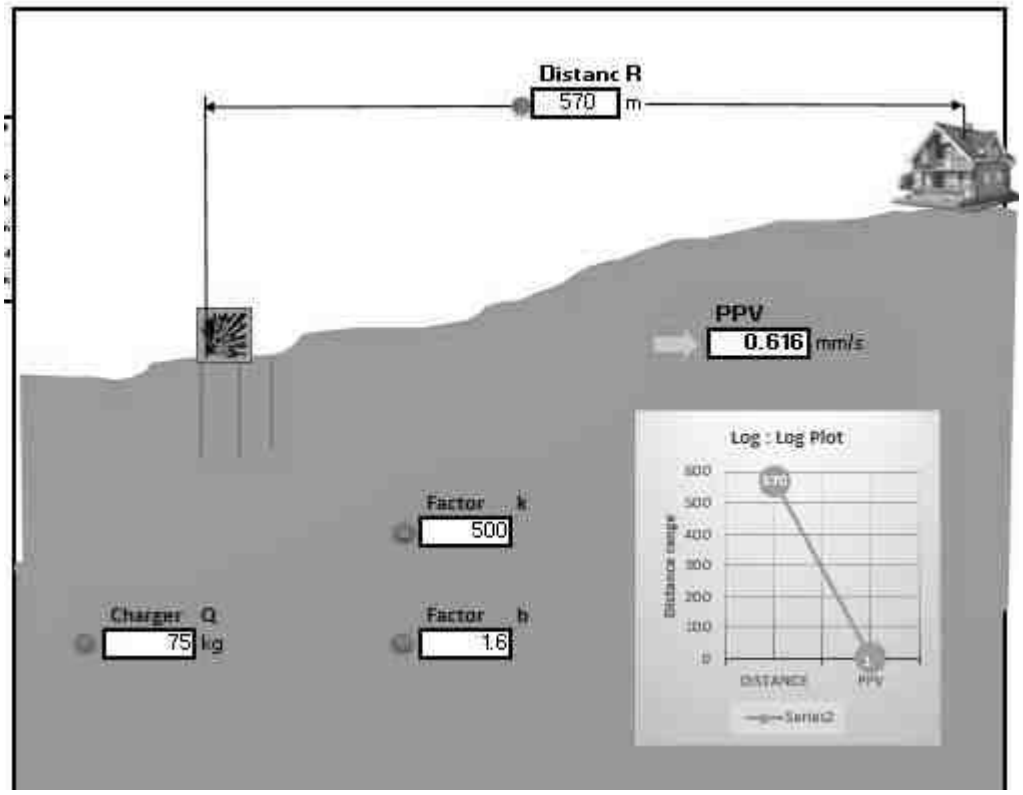
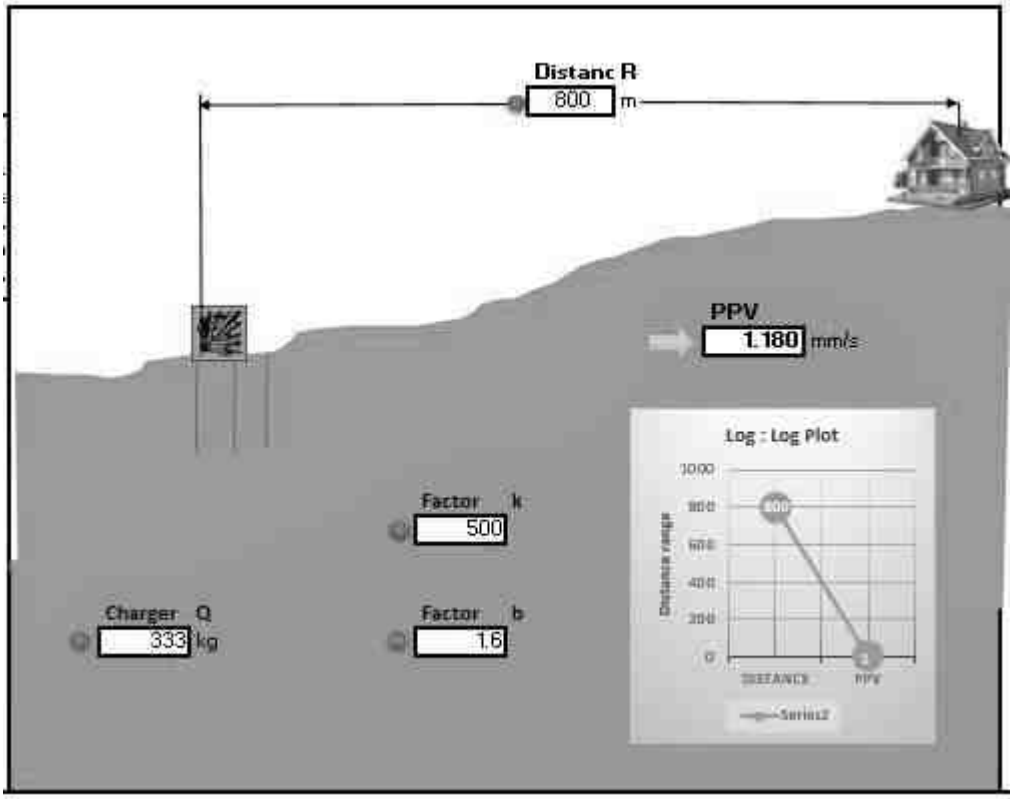


FIGURE 4.7A: GROUND VIBRATION PREDICTION-P2



From the above graph, the charge per blast of 408 kg is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997. But the all the project proponents ensure that the charge per blast shall be less than 53 kg and carry out blasting twice or thrice a day based on the onsite conditions under the supervision of competent person employed. However, as per statutory requirement control measures will be adopted to avoid the impacts due to ground vibrations and fly rocks due to blasting**.**

4.4.3.1 Common Mitigation Measures for Proposed Project

- The blasting operations in the cluster quarries are carried out without deep hole drilling and blasting using delay detonators, which reduces the ground vibrations;
- Proper quantity of explosive, suitable stemming materials and appropriate delay system will be adopted to avoid overcharging and for safe blasting;
- Adequate safe distance from blasting will be maintained as per DGMS guidelines;
- Blasting shelter will be provided as per DGMS guidelines;
- Blasting operations will be carried out only during day time;
- The charge per delay will be minimized and preferably more number of delays will be used per blasts;
- During blasting, other activities in the immediate vicinity will be temporarily stopped;
- Drilling parameters like depth, diameter and spacing will be properly designed to give proper blast;
- A fully trained explosives blast man (Mining Mate, Mines Foreman, 2nd Class Mines Manager/ 1st Class Mines Manager) will be appointed.
- A set of shot firing rules will be drawn up and blasting shall commence outlining the detailed operating procedures that will be followed to ensure that shot firing operations on site take place without endangering the workforce or public.
- Sufficient angular stemming material will be used to confine the explosive force and minimise environmental disturbance caused by venting / misfire.
- The detonators will be connected in a predetermined sequence to ensure that only one charge is detonated at any one time and a NONEL or similar type initiation system will be used.

- The detonation delay sequence shall be designed so as to ensure that firing of the holes is in the direction of free faces so as to minimise vibration effects.
- Appropriate blasting techniques shall be adopted such that the predicted peak particle velocity shall not exceed 8 mm/s.
- Vibration monitoring will be carried out every 6 months to check the efficacy of blasting practices

4.5 ECOLOGY AND BIODIVERSITY

4.5.1 Impact on Ecology and Biodiversity

The impact on biodiversity is difficult to quantify because of its diverse and dynamic characteristics, mining activities generally result in the deforestation, land degradation, water, air and noise pollution which directly or indirectly affect the faunal and floral status of the project area. However, occurrence and magnitude of these impacts are entirely dependent upon the project location, mode of operation and technology involved. Impact prediction is the main footstep in impact evaluation and identifies project actions that are likely to bring significant changes in the project environment. The present study was carried out to predict the likely impacts of the proposed project at Enthoor village and the surrounding environment with special reference to biological attributes covering habitats/ecosystems and associated biodiversity.

The proposed mining activities include removal of some scattered bushes and other thorny species. Although impacts on key habitat elements will occur on a local scale, but on a regional scale they would not be critical for the life cycle needs of the species observed or expected. Moreover, during conceptual stage, the mined-out areas on the top bench will be re-vegetated by planting local /native species and lower benches will be converted into rainwater harvesting structure following completion of mining activities, which will replace habitat resources for fauna species in this locality over a longer time. Existing roads will be used; new roads will not be constructed to reduce impact on flora.

Wild life is not commonly found in the project area and its immediate environs because of lack of vegetal cover and surface water. Except few domestic animals, reptiles, hares and some common birds are observed in the study area.

I. None of the plants will be cut during operational phase of the mine.
II. There shall be negligible air emissions or effluents from the project site. During loading the truck, dust generation will be likely. This shall be a temporary effect and not anticipated to affect the surrounding vegetation significantly.
III. Most of the land in the buffer area is undulating terrain with crop lands, grass patches and small shrubs. Hence, there will be no effect on flora of the region

4.5.2 Mitigation Measures for the Proposed Project

Keeping all this in mind the mitigations have been suggested under environmental management plan. With the understanding of the role of plant species as bio-filter to control air pollution, appropriate plant species (mainly tree species) have been suggested conceding the area/site requirements and needed performance of specific species. The details of year wise proposed plantation program are given in Table 4.13.

The main objective of the green belt is to provide a barrier between the source of pollution and the surrounding areas.

In order to compensate the loss of vegetation cover, it is suggested to carry out afforestation program mainly in proposed areas falls in the cluster earmarked for plantation program as per Approved Mining Plan in different phases. This habitat improvement program would ensure the faunal species to re-colonize and improve the abundance status in the core zone.

The objectives of the green belt cover will cover the following:

- Noise abatement
- Ecological restoration
- Aesthetic, biological and visual improvement of area due to improved vegetative and plantations cover.

4.5.2.2.1. Species Recommendation for Plantation granted in the district

Following points have been considered while recommending the species for plantation:

- Natural growth of existing species and survival rate of various species.
- Suitability of a particular plant species for a particular type of area.
- Creating of biodiversity.

- Fast growing, thick canopy copy, perennial and evergreen large leaf area.
- Efficient in absorbing pollutants without major effects of natural growth.
- The following species may be considering primary for plantation best suited for the prevailing climate condition in the area.

TABLE 4.13: RECOMMENDED SPECIES FOR GREENBELT DEVELOPMENT PLAN

SI.No	Name of the plant (Botanical)	Family Name	Common Name	Habit
1	*Azadirachta indica*	Meliaceae	Neem, Vembu	Tree
2	*Albiziafalcatoria*	Fabaceae	Tamarind, Puliyamaram	Tree
3	*Polyalthialongifolia*	Annonaceae	Kattumaram	Tree
4	*Borassus Flabellifer*	Arecaceae	Palmyra Palm	Tree

The 7.5m Safety distance along the boundary has been identified to be utilized for subsequent Afforestation. However, the afforestation should always be carried out in a systematic and scientific manner. Regional trees like Neem, Pongamia, Pinnata, and Casuarina will be planted along the Lease boundary and avenue plantation will be carried out in respective proposed projects. The rate of survival expected to be 80% in this area. Afforestation Plan is given in Table No.4.13 and budget of green belt development plan are given in Table No.4.14.

TABLE 4.14: GREENBELT DEVELOPMENT PLAN

PROPOSAL – P1					
Year	**No. of trees proposed to be planted**	**Survival %**	**Area to be covered sq.m**	**Name of the species**	**No. of trees expected to be grown**
I	1700	80%	Safety barrier, Village roads & Approach roads	Neem, Pongamia Vilvam etc.,	1360
PROPOSAL – P2					
Year	**No. of trees proposed to be planted**	**Survival %**	**Area to be covered sq.m**	**Name of the species**	**No. of trees expected to be grown**
I	4800	80%	Safety barrier, Village roads & Approach roads	Neem, Pongamia Vilvam etc.,	3840

TABLE 4.15: BUDGET FOR GREENBELT DEVELOPMENT PLAN

PROPASAL- P1							
Activity	**Year**						
	I	II	III	IV	V	**Cost** (Rs)	**Total Cost** (Rs)
Plantation in Nos inside of the site	700	-	-	-	-	@ 200 Rs/ Saplings	Rs. 1,40,000
Plantation in Nos outside of the site	1000	-	-	-	-	@ 100 Rs/ Saplings	Rs. 1,00,000
Renovation of Wire Fencing (1060 meters)	3,18,000	-	-	-	-	@ Rs.300 per meter	Rs. 3,18,000
Renovation of Garland Drain (890 meters)	2,67,000	-	-	-	-	@ Rs.300 per meter	Rs.2,67,000
Total							**Rs. 8,25,000**
PROPASAL- P2							
Activity	**Year**						
	I	II	III	IV	V	**Cost** (Rs)	**Total Cost** (Rs)
Plantation in Nos inside of the site	900	-	-	-	-	@ 200 Rs/ Saplings	Rs. 1,80,000

Plantation in Nos outside of the site	3900	-	-	-	-	@ 100 Rs/ Saplings	Rs. 3,90,000
Renovation of Wire Fencing (1370 meters)	4,11,000	-	-	-	-	@ Rs.300 per meter	Rs.4,11,000
Renovation of Garland Drain (1220 meters)	3,66,000	-	-	-	-	@ Rs.300 per meter	Rs.3,66,000
Total							**Rs. 13,47,000**

After complete extraction of mineral, the excavated pits will be allowed to collect rainwater and seepage water to serve as a reservoir to charge the nearby wells. Fish culture will also be attempted. A bund will be constructed around the pits. In order to minimize the impact of mining on the vegetation outside the mine lease area, it is recommended that adequate protection measures must be implemented. As mining involves movement of vehicles and increased anthropogenic activities, some of the areas can be fenced by involving local people and educating them about increased benefits of such activities.

4.5.3. Anticipated Impact on Fauna

- There is no Wildlife Sanctuary and Biosphere Reserve within 10 km radius of the project site.
- No rare, endemic & endangered species are reported in the buffer zone. However, during the course of mining, the management will practice scientific method of mining with proper Environmental Management Plan including pollution control measures especially for air and noise, to avoid any adverse impact on the surrounding wildlife.
- Fencing around all the proposed mine lease areas will be constructed to restrict the entry of stray animals
- Green belt development will be carried out which will help in minimizing adverse impact on the flora found in the area.

4.5.3.1. Measures for protection and conservation of wildlife species

- Undertaking mitigative measures for conducive environment to the flora and fauna in consultation with Forest Department.
- Dust suppression system will be installed within mine and periphery of mine for all proposed projects
- Plantation around mine area will help in creating habitats for small faunal species and to create better environment for various fauna. Creating and developing awareness for nature and wildlife in the adjoining villages.

4.5.3.2. Mitigation Measures

- All the preventive measures will be taken for growth & development of fauna.
- Creating and development awareness for nature and wildlife in the adjoin villages.
- The workers shall be trained to not harm any wildlife, should it come near the project site. No work shall be carried out after 6.00 pm.

4.5.4. Impact on Aquatic Biodiversity

Mining activities will not disturb the existing aquatic ecology as there is no effluent discharge proposed from the rough stone quarry. There is no natural perennial surface water body within the mine lease area. Hence, aquatic biodiversity is not observed in the mine lease area.

4.5.5. Impact Assessment on Biological Environment

A detail of impact and assessments was mentioned in Table No 4.16.

TABLE 4.16: ECOLOGICAL IMPACT ASSESSMENTS

SI.No	Attributes	Assessment
1	Proximity to national park/wildlife sanctuary/reserve forest /mangroves/ coastline/estuary/sea	'NO'
2	Proposed mining project impact surface water quality that also provide water to wildlife	'NO 'scheduled or threatened wildlife animal sighted regularly core in core area.
3	Located near an area populated by rare or endangered species	NO endangered, critically endangered, vulnerable species sighted in core mining lease area.
4	Proposed project restricts access to waterholes for wildlife	'NO'
5	Project likely to affect migration routes	'NO 'migration route observed during monitoring period.
6	Proposed mining project increase siltation that would affect nearby biodiversity area.	Surface runoff management such as garland drains is proposed to be constructed, so there will be no siltation nearby mining area.
7	Risk of fall/slip or cause death to wild animals due to project activities	'NO'
8	Activities of the project affects the breeding/nesting sites of birds and animals	No breeding and nesting site was identified in mining lease site. The fauna sighted mostly migrated from buffer area.
9	Mining project effect the forest based livelihood/ any specific forest product on which local livelihood depended	'NO'
10	The project release effluents into a water body that also supplies water to a wildlife	No water body near to core zone so chances of water become polluted is low.
11	The project likely to affect wetlands, Fish breeding grounds, marine ecology	'NO'. Wetland was not present in near core Mining lease area. No breeding and nesting ground present in core mining area.
12	Project likely to affect flora of an area, which have medicinal value	'NO'
13	Forestland is to be diverted, has carbon high sequestration	'NO 'There was no forest land diverted.

TABLE 4.17: ANTICIPATED IMPACT OF ECOLOGY AND BIODIVERSITY

Sl. No	Aspect Description	Likely Impacts on Ecology and Biodiversity (EB)	Impact Consequence - Probability Description / Justification	Significance	Mitigation Measures
Pre-Mining Phase					
1	Uprooting of vegetation of lease area	Site specific loss of common floral diversity (Direct impact)	Site possesses common floral (not trees) species. Clearance of these species will not result in loss of flora	Less severe	No immediate action required. However Greenbelt /plantation will be developed in project site and in periphery of the project boundary, which will improve flora and fauna diversity of the project area.
		Site specific loss of associated faunal diversity (Partial impact)	Site supports only common species, Which use wide variety of habitats of the buffer zone reserve forest area. So there is no threat of faunal diversity.		

		-Loss of Habitat (Direct impact)	Site does not form Unique / critical habitat structure for unique flora or fauna.		
Mining phase					
2	Excavation of mineral using machine and labours, Transportation activities will generate noise.	Site-specific disturbance to normal faunal movements at the site due to noise.(Partial impact)	Site does not form unique / critical habitat structure for unique flora or fauna.	Less severe	Mining activity should not be operated after 5PM. Excavation of dump and transportation work should stop before 7PM.
3	Vehicular Movement for transportation of materials will result in generation of dust (SPM) due to haul roads and emission of SO2,NO2,CO etc.	Impact on surrounding agriculture and associated fauna due to deposition of dust and Emission of CO. (Indirect impact)	Impact is less as the agricultural land far from core area.	Less severe	All vehicles will be certified for appropriate Emission levels. More plantation have been suggested Upgrade the vehicles with alternative fuel such biodiesel, methanol and biofuel around the mining area.

4.6 SOCIO ECONOMIC

4.6.1 Anticipated Impact from Proposed Project

- Dust generation from mining activity can have negative impact on the health of the workers and people in the nearby area.
- Approach roads can be damaged by the movement of tippers
- Increase in Employment opportunities both direct and indirect thereby increasing economic status of people of the region

4.6.2 Common Mitigation Measures for Proposed Project

- Good maintenance practices will be adopted for all machinery and equipment, which will help to avert potential noise problems.
- Green belt will be developed in and around the project site as per Central Pollution Control Board (CPCB) guidelines.
- Air pollution control measure will be taken to minimize the environmental impact within the core zone.
- For the safety of workers, personal protective appliances like hand gloves, helmets, safety shoes, goggles, aprons, nose masks and ear protecting devices will be provided as per mines act and rules.
- Benefit to the State and the Central governments through financial revenues by way of royalty, tax, duties, etc.., from this project directly and indirectly.
- From above details, the quarry operations will have highly beneficial positive impact in the area

4.7 OCCUPATIONAL HEALTH AND SAFETY

Occupational health and safety hazards occur during the operational phase of mining and primarily include the following:

- Respiratory hazards
- Noise
- Physical hazards
- Explosive storage and handling

4.7.1 Respiratory Hazards

Long-term exposure to silica dust may cause silicosis the following measures are proposed:

- Cabins of excavators and tippers will be enclosed with AC and sound proof
- Use of personal dust masks will be made compulsory

4.7.2 Noise

Workers are likely to get exposed to excessive noise levels during mining activities. The following measures are proposed for implementation

- No employee will be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection
- The use of hearing protection will be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110 dB(A)
- Ear muffs provided will be capable of reducing sound levels at the ear to at least 85 dB(A)
- Periodic medical hearing checks will be performed on workers exposed to high noise levels

4.7.3 Physical Hazards

The following measures are proposed for control of physical hazards

- Specific personnel training on work-site safety management will be taken up;
- Work site assessment will be done by rock scaling of each surface exposed to workers to prevent accidental rock falling and / or landslide, especially after blasting activities;
- Natural barriers, temporary railing, or specific danger signals will be provided along rock benches or other pit areas where work is performed at heights more than 2m from ground level;
- Maintenance of yards, roads and footpaths, providing sufficient water drainage and preventing slippery surfaces with an all-weather surface, such as coarse gravel will be taken up

4.7.4 Occupational Health Survey

All the persons will undergo pre-employment and periodic medical examination. Employees will be monitored for occupational diseases by conducting the following tests

- General physical tests
- Audiometric tests
- Full chest, X-ray, Lung function tests, Spirometric tests
- Periodic medical examination – yearly
- Lung function test – yearly, those who are exposed to dust
- Eye test

Essential medicines will be provided at the site. The medicines and other test facilities will be provided at free of cost. The first aid box will be made available at the mine for immediate treatment.

First aid training will be imparted to the selected employees regularly. The lists of first aid trained members shall be displayed at strategic places.

4.8 MINE WASTE MANAGEMENT

No waste is anticipated from any of the proposed quarries.

4.9 MINE CLOSURE

Mine closure plan is the most important environmental requirement in mining projects. The mine closure plan should cover technical, environmental, social, legal and financial aspects dealing with progressive and post closure activities. The closure operation is a continuous series of activities starting from the decommissioning of the project. Therefore, progressive mine closure plan should be specifically dealt with in the mining plan and is to be reviewed along with mining plan. As progressive mine closure is a continuous series of activities, it is obvious that the proposals of scientific mining have included most of the activities to be included in the closure plan. While formulating the closure objectives for the site, it is important to consider the existing or the pre-mining land use of the site; and how the operation will affect this activity.

The primary aim is to ensure that the following broad objectives along with the abandonment of the mine can be successfully achieved:

- To create a productive and sustainable after-use for the site, acceptable to mine owners, regulatory agencies, and the public
- To protect public health and safety of the surrounding habitation
- To minimize environmental damage
- To conserve valuable attributes and aesthetics
- To overcome adverse socio-economic impacts.

4.9.1 Mine Closure Criteria

The criteria involved in mine closure are discussed below:

4.9.1.1 Physical Stability

All anthropogenic structures, which include mine workings, buildings, rest shelters etc., remaining after mine decommissioning should be physically stable. They should present no hazard to public health and safety as a result of failure or physical deterioration and they should continue to perform the functions for which they were designed. The design periods and factors of safety proposed should take full account of extreme events such as floods, hurricane, winds or earthquakes, etc. and other natural perpetual forces like erosion, etc.,

4.9.1.2 Chemical Stability

The solid wastes on the mine site should be chemically stable. This means that the consequences of chemical changes or conditions leading to leaching of metals, salts or organic compounds should not endanger public health and safety nor result in the deterioration of environmental attributes. If the pollutant discharge likely to cause adverse impacts is predicted in advance, appropriate mitigation measures like settling of suspended solids or passive treatment to improve water quality as well as quantity, etc., could be planned. Monitoring should demonstrate that there is no adverse effect of pollutant concentrations exceeding the statutory limits for the water, soil and air qualities in the area around the closed mine.

4.9.1.3 Biological Stability

The stability of the surrounding environment is primarily dependent upon the physical and chemical characteristics of the site, whereas the biological stability of the mine site itself is closely related to rehabilitation and final land use. Nevertheless, biological stability can significantly influence physical or chemical stability by stabilizing soil cover, prevention of erosion/wash off, leaching, etc.,

A vegetation cover over the disturbed site is usually one of the main objectives of the rehabilitation programme, as vegetation cover is the best long-term method of stabilizing the site. When the major earthwork components of the rehabilitation programme have been completed, the process of establishing a stable vegetation community begins. For re-vegetation, management of soil nutrient levels is an important consideration. Additions of nutrients are useful under three situations.

- Where the nutrient level of spread topsoil is lower than material in-situ e.g. for development of social forestry
- Where it is intended to grow plants with a higher nutrient requirement than those occurring naturally e.g. planning for agriculture
- Where it is desirable to get a quick growth response from the native flora during those times when moisture is not a limiting factor e.g. development of green barriers

The Mine closure plan should be as per the approved mine plan. The mine closure is a part of approved mine plan and activities of closure shall be carried out as per the process described in mine closure plan.

5. ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

5.0 INTRODUCTION

Consideration of alternatives to a project proposal is a requirement of EIA process. During the scoping process, alternatives to a proposal can be considered or refined, either directly or by reference to the key issues identified. A comparison of alternatives helps to determine the best method of achieving the project objectives with minimum environmental impacts or indicates the most environmentally friendly and cost-effective options.

5.1 FACTORS BEHIND THE SELECTION OF PROJECT SITE

Tvl.Thirupathi Blue metal & M.Sand Rough Stone & Gravel Quarry Project at Enthoor Village is a mining project for excavation of Rough Stone, which is site specific.

The proposed mining lease areas have following advantages: -

- The mineral deposit occurs in a non-forest area.
- There is no habitation within the project area; hence no R & R issues exist.
- There is no river, stream, nallah and water bodies in the applied mine lease areas.
- Availability of skilled, semi-skilled and unskilled workers in this region.
- All the basic amenities such as medical, firefighting, education, transportation, communication and infrastructural facilities are well connected and accessible.
- The mining operations will not intersect the ground water level. Hence, no impact on ground water environment.
- Study area falls in seismic zone – II, there is no major history of landslides, earthquake, subsidence etc., recorded in the past history.

5.2 ANALYSIS OF ALTERNATIVE SITE

No alternatives are suggested as all the mine sites are mineral specific

5.3 FACTORS BEHIND SELECTION OF PROPOSED TECHNOLOGY

Mechanized open cast mining operation with drilling and blasting method will be used to extract Rough Stone in the area. All the applied mining lease areas have following advantages –

- As the mineral deposition is homogeneous and batholith formation, therefore opencast method of working is preferred over underground method
- The material will be loaded with the help of excavators into dumpers / trippers and transported to the needy customers.
- Blasting and availability of drills along with controlled blasting technology gives desired fragmentation so that the mineral is handled safely and used without secondary blasting.
- Semi-skilled labours fit for quarrying operations are easily available around the nearby villages.

5.4 ANALYSIS OF ALTERNATIVE TECHNOLOGY

Open cast mechanized method has been selected for these projects. This technology is having least gestation period, economically viable, safest and less labour intensive. The method has inbuilt flexibility for increasing or decreasing the production as per market condition.

6. ENVIRONMENTAL MONITORING PROGRAMME

6.0 GENERAL

The monitoring and evaluation of environmental parameters indicates potential changes occurring in the environment, which paves way for implementation of rectifying measures wherever required to maintain the status of the natural environment. Evaluation is also a very effective tool to judge the effectiveness or deficiency of the measures adopted and provides insight for future corrections.

The main objective of environmental monitoring is to ensure that the obtained results in respect of environmental attributes and prevailing conditions during operation stage are in conformity with the prediction during the planning stage. In case of substantial deviation from the earlier prediction of results, this forms as base data to identify the cause and suggest remedial measures. Environmental monitoring is mandatory to meet compliance of statutory provisions under the Environment (Protection) Act, 1986, relevant conditions regarding monitoring covered under EC orders issued by the SEIAA as well as the conditions set forth under the order issued by Tamil Nadu Pollution Control Board while granting CTO.

6.1 METHODOLOGY OF MONITORING MECHANISM

Implementation of EMP and periodic monitoring will be carried out by Respective Project Proponents. A comprehensive monitoring mechanism has been devised for monitoring of impacts due to proposed projects; Environmental protection measures like dust suppression, control of noise and blast vibrations, maintenance of machinery and vehicles, housekeeping in the mine premises, plantation, implementation of Environmental Management Plan and environmental clearance conditions will be monitored by the Respective Mine Management. On the other hand, implementation of area level protection measures like green belt development, environmental quality monitoring etc., are taken up by a senior executive who reports to their Mine Management.

An Environment monitoring cell (EMC) will be constituted to monitor the implementation of EMP and other environmental protection measures in all the proposed quarries.

The responsibilities of this cell will be:

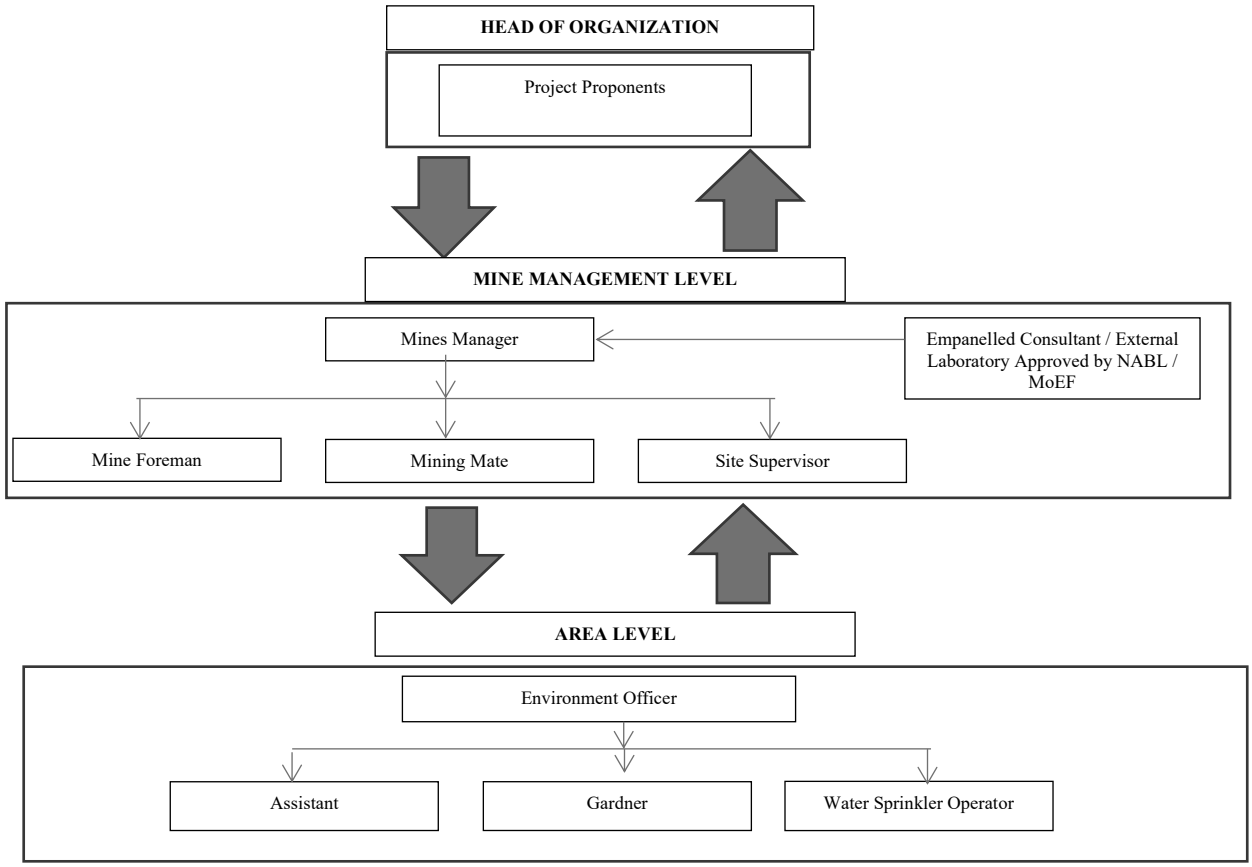
- Implementation of pollution control measures
- Monitoring programme implementation
- Post-plantation care
- To check the efficiency of pollution control measures taken
- Any other activity as may be related to environment
- Seeking expert’s advice when needed.

The environmental monitoring cell will co-ordinate all monitoring programs at site and data thus generated will be regularly furnished to the State regulatory agencies as compliance status reports.

The sampling and analysis report of the monitored environmental attributes will be submitted to the Tamil Nadu Pollution Control Board (TNPCB) at a frequency of half-yearly and yearly by each proposed project proponent. The half-yearly reports are submitted to Ministry of Environment and Forest, Regional Office and SEIAA as well.

The sampling and analysis of the environmental attributes will be as per the guidelines of Central Pollution Control Board (CPCB)/Ministry of Environment, Forest and Climate Change (MoEF & CC).

FIGURE 6.1: PROPOSED ENVIRONMENTAL MONITORING CELL P1 & P2



* The Environmental Monitoring Cell will be formed in proposed project

6.2 IMPLEMENTATION SCHEDULE OF MITIGATION MEASURES

The mitigation measures proposed in Chapter-4 will be implemented so as to reduce the impact on the environment due to the operations of the proposed project. Implementation schedule of mitigation measures is given in Table 6.1.

TABLE 6.1 IMPLEMENTATION SCHEDULE FOR PROPOSED PROJECT

SI No.	Recommendations	Time Period	Schedule
1	Land Environment Control Measures	Before commissioning of the project	Immediately after the commencement of project
2	Soil Quality Control Measures	Before commissioning of the project	Immediately after the commencement of project
3	Water Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
4	Air Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
5	Noise Pollution Control Measures	Before commissioning of the project and along with mining operation	Immediately and as project progress
6	Ecological Environment	Phase wise implementation every year along with mine operations	Immediately and as project progress

6.3 MONITORING SCHEDULE AND FREQUENCY

Monitoring shall confirm that commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges, emissions and wastes, for measurement against statutory standards. Monitoring may include socio-economic interaction, through local liaison activities or even assessment of complaints.

The environmental monitoring will be conducted in the mine operations as follows:

- Air quality;
- Water and wastewater quality;
- Noise levels;
- Soil Quality; and
- Greenbelt Development

The details of monitoring are detailed in Table 6.2

TABLE 6.2: PROPOSED MONITORING SCHEDULE POST EC

S.No.	Environment Attributes	Location	Monitoring		Parameters
			Duration	Frequency	
1	Air Quality	2 Locations (1 Core & 1 Buffer)	24 hours	Once in 6 months	Fugitive Dust, $PM_{2.5}$, PM_{10}, SO_2 and NO_x.
2	Meteorology	At mine site before start of Air Quality Monitoring & IMD Secondary Data	Hourly / Daily	Continuous online monitoring	Wind speed, Wind direction, Temperature, Relative humidity and Rainfall
3	Water Quality Monitoring	2 Locations (1SW & 1 GW)	-	Once in 6 months	Parameters specified under IS:10500, 1993 & CPCB Norms
4	Hydrology	Water level in open wells in buffer zone around 1 km at specific wells	-	Once in 6 months	Depth in bgl
5	Noise	2 Locations (1 Core & 1 Buffer)	Hourly – 1 Day	Once in 6 months	Leq, Lmax, Lmin, Leq Day & Leq Night
6	Vibration	At the nearest habitation (in case of reporting)	–	During blasting Operation	Peak Particle Velocity
7	Soil	2 Locations (1 Core & 1 Buffer)	–	Once in six months	Physical and Chemical Characteristics
8	Greenbelt	Within the Project Area	Daily	Monthly	Maintenance

Source: Guidance of manual for mining of minerals, February 2010

6.4 BUDGETARY PROVISION FOR EMP

The cost in respect of monitoring of environmental attributes, parameter to be monitored, sampling/monitoring locations with frequency and cost provision against each proposal is shown in Table 6.3. Monitoring work will be outsourced to external laboratory approved by NABL / MoEF.

The proposed capital cost for Environmental Monitoring Programme is **Rs. 76,000/-** and the recurring cost is **Rs 3,80,000/-** per annum for each Proposed Project.

TABLE 6.3 ENVIRONMENT MONITORING BUDGET

PROPOSAL – P1 & P2			
Sl.No.	**Parameter**	**Capital Cost**	**Recurring Cost per annum**
1	Air Quality	Rs. 76,000/-	Rs. 76,000/-
2	Meteorology		
3	Water Quality		
4	Hydrology		
5	Soil Quality		
6	Noise Quality		
7	Vibration Study		

Total	**Rs 76,000/-**	**Rs 76,000/-**

Source: Approved Mining Plan

6.5 REPORTING SCHEDULES OF MONITORED DATA

The monitored data on air quality, water quality, noise levels and other environmental attributes will be periodically examined by the Cluster Mine Management Coordinator and Respective Head of Organization for taking necessary corrective measures. The monitoring data will be submitted to Tamil Nadu State Pollution Control Board in the Compliance to CTO Conditions & environmental audit statements every year to MoEF & CC and Half-Yearly Compliance Monitoring Reports to MoEF & CC Regional Office and SEIAA.

Periodical reports to be submitted to: -

- MoEF & CC – Half yearly status report
- TNPCB - Half yearly status report
- Department of Geology and Mining: quarterly, half yearly annual reports

Besides the Mines Manager/Agent of respective project will submit the periodical reports to –

- Director of mines safety,
- Labour enforcement officer,
- Controller of explosives as per the norms stipulated by the department.

7. ADDITIONAL STUDIES

7.0 GENERAL

The following Additional Studies were done as per items identified by project proponent and items identified by regulatory authority. And items identified by public and other stakeholders will be incorporated after Public Hearing.

- Public Consultation
- Risk Assessment
- Disaster Management Plan
- Cumulative Impact Study
- Plastic Waste Management

7.1. PUBLIC CONSULTATION

Application to The Member Secretary of the Tamil Nadu Pollution Control Board (TNPCB) to conduct Public Hearing in a systematic, time bound and transparent manner ensuring widest possible public participation at the project site or in its close proximity in the district is submitted along with this Draft EIA / EMP Report and the outcome of public hearing proceedings will be detailed in the Final EIA/EMP Report.

7.2 RISK ASSESSMENT

The methodology for the risk assessment has been based on the specific risk assessment guidance issued by the Directorate General of Mine Safety (DGMS), Dhanbad, vide Circular No.13 of 2002, dated 31st December, 2002. The DGMS risk assessment process is intended to identify existing and probable hazards in the work environment and all operations and assess the risk levels of those hazards in order to prioritize those that need immediate attention. Further, mechanisms responsible for these hazards are identified and their control measures, set to timetable are recorded along with pinpointed responsibilities.

The whole quarry operation will be carried out under the direction of a Qualified Competent Mine Manager holding certificate of competency to manage a metalliferous mine granted by the DGMS, Dhanbad for all proposed projects. Risk Assessment is all about prevention of accidents and to take necessary steps to prevent it from happening.

Factors of risks involved due to human induced activities in connection with these proposed mining & allied activities with detailed analysis of causes and control measures for the mine is given in below Table 7.1.

TABLE 7.1 RISK ASSESSMENT& CONTROL MEASURES

S.No	Risk factors	Causes of risk	Control measures
1	Accidents due to explosives and heavy mining machineries	Improper handling and unsafe working practice	All safety precautions and provisions of Mine Act, 1952, Metalliferous Mines Regulation, 1961 and Mines Rules, 1955 will be strictly followed during all mining operations; Workers will be sent to the Training in the nearby Group Vocational Training Centre Entry of unauthorized persons will be prohibited; Fire-fighting and first-aid provisions in the mine office complex and mining area; Provisions of all the safety appliances such as safety boot, helmets, goggles etc. will be made available to the employees and regular check for their use Working of quarry, as per approved plans and regularly updating the mine plans; Cleaning of mine faces on daily basis shall be daily done in order to avoid any overhang or undercut; Handling of explosives, charging and firing shall be carried out by competent persons only under the supervision of a Mine Manager; Maintenance and testing of all mining equipment as per manufacturer‘s guidelines.

2	Drilling	Improper and unsafe practices Due to high pressure of compressed air, hoses may burst Drill Rod may break	Safe operating procedure established for drilling (SOP) will be strictly followed. Only trained operators will be deployed. No drilling shall be commenced in an area where shots have been fired until the blaster/blasting foreman has made a thorough Examination of all places, Drilling shall not be carried on simultaneously on the benches at places directly one above the other. Periodical preventive maintenance and replacement of worn out accessories in the compressor and drill equipment as per operator manual. All drills unit shall be provided with wet drilling shall be maintained in efficient working in condition. Operator shall regularly use all the personal protective equipment.
4	Blasting	Fly rock, ground vibration, Noise and dust. Improper charging, stemming & Blasting/ fining of blast holes Vibration due to movement of vehicles	Restrict maximum charge per delay as per regulations and by optimum blast hole pattern, vibrations will be controlled within the permissible limit and blasting can be conducted safely. SOP for Charging, Stemming & Blasting/Firing of Blast Holes will be followed by blasting crew during initial stage of operation Shots are fired during daytime only. All holes charged on any one day shall be fired on the same day. The danger zone will be distinctly demarcated (by means of red flags)
5	Transportation	Potential hazards and unsafe workings contributing to accident and injuries Overloading of material While reversal & overtaking of vehicle Operator of truck leaving his cabin when it is loaded.	Before commencing work, drivers personally check the dumper/truck/tipper for oil(s), fuel and water levels, tyre inflation, general cleanliness and inspect the brakes, steering system, warning devices including automatically operated audio-visual reversing alarm, rear view mirrors, side indicator lights etc., are in good condition. Not allow any unauthorized person to ride on the vehicle nor allow any unauthorized person to operate the vehicle. Concave mirrors should be kept at all corners All vehicles should be fitted with reverse horn with one spotter at every tipping point Loading according to the vehicle capacity Periodical maintenance of vehicles as per operator manual
6	Natural calamities	Unexpected happenings	Escape Routes will be provided to prevent inundation of storm water Fire Extinguishers & Sand Buckets
7	Failure of Mine Benches and Pit Slope	Slope geometry, Geological structure	Ultimate or over all pit slope shall be below 60° and each bench height shall be 5m height.

Source: Analysed and Proposed by FAE & EC

7.3 DISASTER MANAGEMENT PLAN

Natural disasters like Earthquake, Landslides have not been recorded in the past history as the terrain is categorized under seismic zone II. The area is far away from the sea hence the disaster due to heavy floods and tsunamis are not anticipated

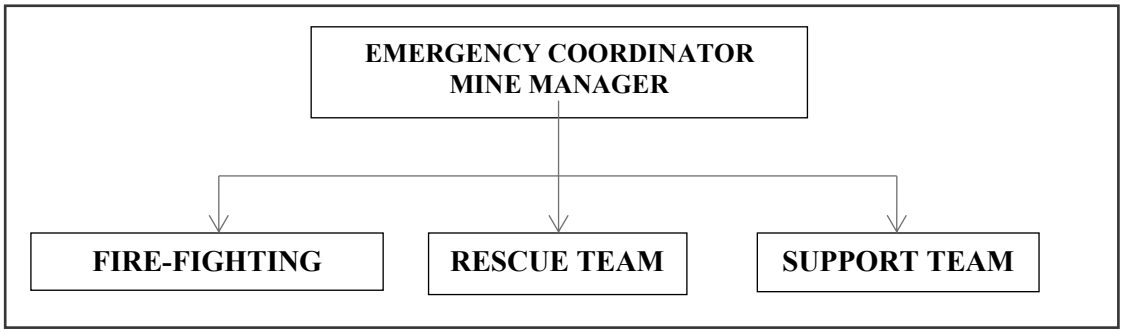
The Disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities.

The objective of the Disaster Management Plan is to make use of the combined resources of the mine and the outside services to achieve the following:

- Rescue and medical treatment of casualties;
- Safeguard other people;
- Minimize damage to property and the environment;
- Initially contain and ultimately bring the incident under control;
- Secure the safe rehabilitation of affected area; and
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.

In case a disaster takes place, despite preventive actions, disaster management will have to be done in line with the descriptions below. There is an organization proposed for dealing with the emergency situations and the coordination among key personnel and their team has been shown in Fig 7.1.

FIGURE 7.1: DISASTER MANAGEMENT TEAM LAYOUT FOR P1 & P2



The emergency organization shall be headed by emergency coordinator who will be qualified competent mine manager. In his absence senior most people available at the mine shall be emergency coordinator till arrival of mine manager. There would be three teams for taking care of emergency situations – Fire-Fighting Team, Rescue Team and Support Team. The proposed composition of the teams is given in Table 7.2.

TABLE 7.2: PROPOSED TEAMS TO DEAL WITH EMERGENCY SITUATION

DESIGNATION	QUALIFICATION
FIRE-FIGHTING TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Team Member	Mines Foreman
Team Member	Mining Mate
RESCUE TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Team Member/ Incident Controller (IC)	Environment Officer
Team Member	Mining Foreman
SUPPORT TEAM	
Team Leader/ Emergency Coordinator (EC)	Mines Manager
Assistant Team Leader	Environment Officer
Team Member	Mining Mate
Security Team Leader/ Emergency Security Controller	Mines Foreman

Once the mine becomes operational, the above table along with names of personnel will be prepared and made easily available to workers for respective proposed quarries. A mobile communication network and wireless shall connect Mine Emergency Control Room (MECR) to control various departments of the mine, fire station and neighbouring industrial units/mines.

Roles and responsibilities of emergency team –

(a) Emergency coordinator (EC)

The emergency coordinator shall assume absolute control of site and shall be located at MECR.

(b) Incident controller (IC)

Incident controller shall be a person who shall go to the scene of emergency and supervise the action plan to overcome or contain the emergency. Shift supervisor or Environmental Officer shall assume the charge of IC.

(c) Communication and advisory team

The advisory and communication team shall consist of heads of Mining Departments i.e., Mines Manager

(d) Roll call coordinator

The Mine Foreman shall be Roll Call Coordinator. The roll call coordinator will conduct the roll call and will evacuate the mine personnel to assembly point. His prime function shall be to account for all personnel on duty.

(e) Search and rescue team

There shall be a group of people trained and equipped to carryout rescue operation of trapped personnel. The people trained in first aid and fire-fighting shall be included in search and rescue team.

(f) Emergency security controller

Emergency Security Controller shall be senior most security person located at main gate office and directing the outside agencies e.g. fire brigade, police, doctor and media men etc.,

Emergency control procedure –

The onset of emergency, will in all probability, commence with a major fire or explosion or collapse of wall along excavation and shall be detected by various safety devices and also by members of operational staff on duty. If located by a staff member on duty, he (as per site emergency procedure of which he is adequately briefed) will go to nearest alarm call point, break glass and trigger off the alarms. He will also try his best to inform about location and nature of accident to the emergency control room. In accordance with work emergency procedure the following key activities will immediately take place to interpret and take control of emergency.

- On site fire crew led by a fireman will arrive at the site of incident with fire foam tenders and necessary equipment.
- Emergency security controller will commence his role from main gate office
- Incident controller shall rush to the site of emergency and with the help of rescue team and will start handling the emergency.
- Site main controller will arrive at MECR with members of his advisory and communication team and will assume absolute control of the site.
- He will receive information continuously from incident controller and give decisions and directions to:
    - Incident controller
    - Mine control rooms
    - Emergency security controller

Proposed fire extinguishers at different locations –

The following type of fire extinguishers has been proposed at strategic locations within the mine.

TABLE 7.3: PROPOSED FIRE EXTINGUISHERS AT DIFFERENT LOCATIONS

LOCATION	TYPE OF FIRE EXTINGUISHERS
Electrical Equipment's	CO_2 type, foam type, dry chemical powder type
Fuel Storage Area	CO_2 type, foam type, dry chemical powder type, Sand bucket
Office Area	Dry chemical type, foam type

Alarm system to be followed during disaster –

On receiving the message of disaster from Site Controller, fire-fighting team, the mine control room attendant will sound siren wailing for 5 minutes. Incident controller will arrange to broadcast disaster message through public address system. On receiving the message of "Emergency Over" from Incident Controller the emergency control room attendant will give "All Clear Signal", by sounding alarm straight for 2 minutes.

The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster. In order to prevent or take care of hazard / disasters if any the following control measures have been adopted.

- All safety precautions and provisions of Metalliferous Mines Regulations (MMR), 1961 is strictly followed during all mining operations.
- Observance of all safety precautions for blasting and storage of explosives as per MMR 1961.
- Entry of unauthorized persons into mine & allied areas is completely prohibited.
- Fire-fighting and first-aid provisions in the mines office complex and mining area are provided.
- Provisions of all the safety appliances such as safety boot, helmets, goggles, dust masks, ear plugs and ear muffs etc. are made available to the employees and the use of same is strictly adhered to through regular monitoring.
- Training and refresher courses for all the employees working in hazardous premises.
- Working of mine, as per approved plans and regularly updating the mine plans.
- Cleaning of mine faces is regularly done.
- Handling of explosives, charging and blasting are carried out only by qualified persons following SOP.
- Checking and regular maintenance of garland drains and earthen bunds to avoid any inflow of surface water in the mine pit.
- Provision of high-capacity standby pumps with generator sets with enough quantity of diesel for emergency pumping especially during monsoon.
- A blasting SIREN is used at the time of blasting for audio signal.
- Before blasting and after blasting, red and green flags are displayed as visual signals.
- Warning notice boards indicating the time of blasting and NOT TO TRESPASS are displayed at prominent places.
- Regular maintenance and testing of all mining equipment were carried out as per manufacturer's guidelines.

7.4 CUMULATIVE IMPACT STUDY

For easy representation of Proposed and Existing Quarries in the Cluster are given unique codes and identifies and studied in this EIA /EMP Report.

TABLE 7.4: LIST OF QUARRIES WITHIN 500 METER RADIUS

CODE	Name of the Owner	S.F. Nos	Extent in Ha	Status
P1	Tvl. Thirupathi Blue Metal & M.Sand, No.32, Bajanai Kovil Street, Natham Kariyacherry Village, Mullikolathur Post, Thirukazhukundram Taluk, Kancheepuram District.	6/1, 7/2, 7/3 and 7/4	2.85.0	TOR obtained vide Lr.No. SEIAA-TN/F.No.9534/SEAC/ToR-1347/2022 Dated: 10.02.2023
P2	Tvl. Thirupathi Blue Metal & M.Sand, No.32, Bajanai Kovil Street, Natham Kariyacherry Village, Mullikolathur Post, Thirukazhukundram Taluk, Kancheepuram District.	2/1B, 2/2, 2/3 (P), 2/5, 3, 4/1 & 4/2,	8.00.05	TOR obtained vide Lr.No. SEIAA-TN/F.No.9668 /ToR-1351/2022 Dated: 16.02.2023
TOTAL EXTENT			**10.85.05**	
EXISTING QUARRIES				
CODE	**Name of the Owner**	**S.F. Nos**	**Extent in Ha**	**Status**

E1	R.Vignesh.S/o Ramasamy, Madipakkam,Chennai-91	5/1,2,3,4,5,6,7	3.94.0	26.12.2019 to 25.12.2024
E2	Tvl. Sri Balaji Blue metals and M.Sand, No.33/8,Mailam Road,Indira Nagar,Tindivanam	163/1, 163/2 (P)	2.79.0	19.09.2019 to 18.09.2024
TOTAL EXTENT			**6.79.50**	
Abandoned QUARRY				
EX-1	Sri Balaji Blue metals, 97,Marakkanam main road,Brammadesam village& post, Tindivanam Taluk,Viluppuram District.	**6/1,7/2,3,4**	2.85.0	18.04.2013 to 17.04.2018
TOTAL EXTENT			**0.69.0**	
TOTAL CLUSTER EXTENT			**17.64.55**	

- **Cluster area is calculated as per MoEF & CC Notification – S.O. 2269 (E) Dated: 01.07.2016**

TABLE 7.5: SALIENT FEATURES OF PROPOSAL "P1"

PROPOSAL "P1"		
Name of the Project	Tvl. Thirupathi Blue Metal & M. Sand Rough Stone & Gravel Quarry	
Toposheet No	57-P/16	
Latitude between	12^0 13'17.9159" N to $12^0$13'29.3407" N	
Longitude between	79^0 47'13.2559" E to $79^0$47'19.9500" E	
Highest Elevation	100m AMSL	
Proposed Depth of Mining	37 m bgl (2 m topsoil +35m Rough Stone)	
Geological Resources	Rough Stone in m^3	Gravel m^3
	10,01,221	54,758
Mineable Reserves	Rough Stone in m^3	Gravel m^3
	2,61,972	27,878
Yearwise production after bench reduction	Rough Stone in m^3	Gravel m^3
	2,59,242	27,878
Existing pit Dimension	Pit I: 1978 Area in S. qm x 2m (D) Pit II: 558 Area in S. qm x 2m(D) Pit III: 3812 Area in S. qm x 12m(D) Pit IV: 1282 Area in S. qm x 12m(D)	
Previous EC details	It is previously operated by Sri balaji blue metals from 18.04.2013 to 17.04.2018 Lr.No. SEIAA-TN/F.No.767/EC/1(a)/156 dated: 27.03.2013.	
Ultimate Pit Dimension	359m (L) x 105m (W) x 37m (D)	
Water Level measured in the surrounding area	51m-47m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is exhibits almost plain terrain. The area has gentle sloping towards eastern side. The altitude of the area is 100m (max) above mean sea level. The area is covered by 2m thickness of gravel formation. Massive Charnockite is found after 2m of Gravel formation which is clearly inferred from the existing quarrying pit.	
Machinery proposed	Jack Hammer	8 Nos
	Compressor	2 Nos
	Hydraulic Excavator& Rock Breaker	2 Nos
	Tippers	4 Nos
Blasting method and type of Explosives proposed	Controlled Blasting Method by shot hole drilling (30.-32mm dia hole) and small dia of 25mm slurry explosive are proposed to use for winning of Rough Stone. No deep hole drilling is proposed.	

Proposed Manpower Deployment	34 Nos	
Project Cost	Rs.54,37,000/-	
CER Cost	Rs.5,00,000/-	
Nearby Water Bodies	odai	500m_NE
	Tank	260m SW
	Kunnapakkam Lake	800m_E
	Ariyathangal Lake	860m_SW
	Endur Lake	1.3Km_S
	Bramaddesam Lake	3Km_SW
	Munnur Lake	4Km_SE
	Nallavur Lake	8.5Km_SW
	Puthunagara Lake	8.5Km_SW
	Nolambur Lake	6Km_NW
	Kilsevur Lake	4Km_NW
	Ongur Stream	8.5Km_NE
Greenbelt Development Plan	1700 trees will be planned in safety area, approach road and panchayat roads	
Proposed Water Requirement	1.5 KLD	
Nearest Habitation	570m South West	
PROPOSAL "P2"		
Name of the Project	Tvl. Thirupathi Blue Metal & M. Sand Rough Stone & Gravel Quarry	
Toposheet No	57-P/16	
Latitude between	12^0 13'24.51" N to $12^0$13'39.076" N	
Longitude between	79^0 47'19.52" E to $79^0$47'30.78" E	
Highest Elevation	100m AMSL	
Proposed Depth as per Mining plan	55m bgl (2m Gravel + 53m Rough Stone)	
Geological Resources	Rough Stone in m^3	Gravel m^3
	42,37,138	1,59,892
Mineable Reserves	Rough Stone in m^3	Gravel m^3
	24,07,748	1,40,744
Yearwise production as per ToR	Rough Stone in m^3	Gravel m^3
	11,55,048	1,40,744
Ultimate Pit Dimension	Pit I: 132m (L) x 196m (W) x 50m (D) Pit II: 186m (L) x 256m (W) x 55m (D)	
Water Level measured in the surrounding area	65m-68m bgl	
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting	
Topography	The lease applied area is plain terrain. The area has gentle sloping towards Southeastern side. The altitude of the area is 100m (max) above mean sea level. The area is covered by 2m thickness of Gravel formation. Massive Charnockite is found after 2m of Gravel formation which is clearly inferred from the existing quarrying pit.	
Machinery proposed	Jack Hammer	6 Nos
	Compressor	2 Nos
	Wagon Drill	2 Nos
	Excavator with Bucket and Rock Breaker	2 Nos
	Tippers	8 Nos
Blasting method and type of Explosives proposed	Controlled Blasting Method by shot hole drilling (30.-32mm dia hole) and small dia of 25mm slurry explosive are proposed to use for winning of Rough Stone.	
Proposed Manpower Deployment	48Nos	
Project Cost	Rs. 5,70,44,000/-	
CER Cost	Rs.5,00,000/-	

Nearby Water Bodies	odai	230m_E
	Tank	470m_SW
	Kunnapakkam Lake	970m_SW
	Ariyathangal Lake	1.1Km_SW
	Endur Lake	1.5Km_S
	Bramaddesam Lake	3.2Km_SW
	Munnur Lake	3.8Km_SE
	Nallavur Lake	9Km_SW
	Puthunagara Lake	9Km_SW
	Nolambur Lake	6.3Km_NW
	Kilsevur Lake	4.3Km_NW
	Ongur Stream	8Km_NE
Greenbelt Development Plan	4800 trees will be planned in safety area, approach road and panchayat roads	
Proposed Water Requirement	4.0 KLD	
Nearest Habitation	800m Southwest	

TABLE 7.6: SALIENT FEATURES OF PROPOSAL "E1"

Name of the Quarry	Thiru. R.Vignesh Rough Stone & Gravel Quarry		
Toposheet No	57-P/16		
Latitude between	12°13'19.10" N- 12°13'28.51" N		
Longitude between	79°47'19.97" E- 79°47'26.85" E		
Yearwise Production	Rough Stone in m^3	Weathered Gravel in m^3	Gravel in m^3
	6,75,745	87,126	62,562
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Machinery proposed	Jack Hammer	7 Nos	
	Compressor	3 Nos	
	Hydraulic Excavator	3 Nos	
	Tippers	6 Nos	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.		
Proposed Manpower Deployment	30 Nos		
Project Cost	Rs. 56,74,000/-		
CER Cost	Rs. 5,00,000/-		

Source: Approved Mining Plan

TABLE 7.7: SALIENT FEATURES OF PROPOSAL "E2"

Name of the Quarry	Tvl.Sri Balaji Blue Metals and M.Sand Rough Stone & Gravel Quarry		
Toposheet No	57-P/16		
Latitude between	12°13'05.47"N to 12°13'13.31"N		
Longitude between	79°47'04.29"E to 79°47'10.26"E		
Yearwise Production	Rough Stone in m^3	Weathered Gravel in m^3	Earth formation in m^3
	5,05,750	-	62,769
Method of Mining	Opencast Mechanized Mining Method involving drilling and blasting		
Machinery proposed	Jack Hammer	7 Nos	
	Compressor	4 Nos	
	Hydraulic Excavator	3 Nos	
	Tippers	7 Nos	
Blasting Method	Controlled Blasting Method by shot hole drilling and small dia of 25mm slurry explosive are proposed to be used for shattering and		

	heaving effect for removal and winning of Rough Stone. No deep hole drilling is proposed.
Proposed Manpower Deployment	35 Nos
Project Cost	Rs. 56,97,360/-
CER Cost	Rs. 5,00,000/-

Source: Approved Mining Plan

The Cumulative Impact is mainly anticipated due to drilling & blasting and excavation and transportation activities in all the quarries (proposed and existing) within the cluster and major impact anticipated is on Air & Noise Environment and Ground Vibrations due to blasting.

Air Environment –

Calculating the Cumulative Load of Mining within the cluster is as shown in table 7.16 & 7.17.

TABLE 7.8: CUMULATIVE PRODUCTION LOAD OF ROUGH STONE

Quarry	Production for five year plan period	Per Year Production in m^3	Per Day Production in m^3	Number of Lorry Load Per Day
P1	2,61,972	52,394	174	15
P2	11,55,048	2,31,009	770	64
Total	**14,17,020**	**2,83,403**	**944**	**79**
E1	6,75,745	1,35,149	450	38
E2	5,05,750	1,01,150	337	28
Total	**11,81,495**	**2,36,299**	**787**	**66**
Grand Total	**25,98,515**	**5,19,702**	**1,731**	**145**

TABLE 7.9: CUMULATIVE PRODUCTION LOAD OF GRAVEL & EARTH FORMATION

Quarry	Production for Three year plan period	Per Year Production in m^3	Per Day Production in m^3	Number of Lorry Load Per Day
P1	27878	9,292	31	3
P2	140744	46,914	156	14
Total	**1,68,622**	**56,206**	**187**	**17**
E1	62562	20,854	70	6
E2	62769	20,923	70	6
Total	**1,25,331**	**41,777**	**140**	**12**
Grand Total	**2,93,953**	**97,983**	**327**	**29**

On a cumulative basis considering the proposed and existing quarries, it can be seen that the overall production of Rough Stone is 1731m^3 per day and overall production of Gravel is 327 m^3 per day with a capacity of 145 trips of Rough Stone per day and 29 Trips per day of Gravel from the cluster.

Note: Per day production of Rough Stone is calculated for 5 Years Lease Period and for Gravel production with 2 or 3 years of production period. And the load of existing quarries is covered under existing environment of the cluster.

Based on the above production quantities the emissions due to various activities in all the 4 mines includes various activities like ground preparation, excavation, handling and transport of ore. These activities have been analysed systematically basing on USEPA-Emission Estimation Technique Manual, for Mining AP-42, to arrive at possible emissions to the atmosphere and estimated emissions are given in Table 7.18.

TABLE 7.10: EMISSION ESTIMATION FROM QUARRIES WITHIN 500 METER RADIUS

EMISSION ESTIMATION FOR QUARRY "P1"				
	Activity	**Source type**	**Value**	**Unit**
Estimated Emission Rate for PM_{10}	Drilling	Point Source	0.090953573	g/s
	Blasting	Point Source	0.001505613	g/s
	Mineral Loading	Point Source	0.043260263	g/s
	Haul Road	Line Source	0.002494166	g/s
	Overall Mine	Area Source	0.060538878	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.000835903	g/s

Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000052590	g/s
EMISSION ESTIMATION FOR QUARRY "P2"				
Estimated Emission Rate for PM_{10}	**Activity**	**Source type**	**Value**	**Unit**
	Drilling	Point Source	0.134694600	g/s
	Blasting	Point Source	0.010724212	g/s
	Mineral Loading	Point Source	0.049349650	g/s
	Haul Road	Line Source	0.002526968	g/s
	Overall Mine	Area Source	0.102645565	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.003197641	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000550162	g/s
EMISSION ESTIMATION FOR QUARRY "E1"				
Estimated Emission Rate for PM_{10}	**Activity**	**Source type**	**Value**	**Unit**
	Drilling	Point Source	0.116692130	g/s
	Blasting	Point Source	0.005233862	g/s
	Mineral Loading	Point Source	0.046664303	g/s
	Haul Road	Line Source	0.002507767	g/s
	Overall Mine	Area Source	0.072492930	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.001804321	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000157119	g/s
EMISSION ESTIMATION FOR QUARRY "E2"				
Estimated Emission Rate for PM_{10}	**Activity**	**Source type**	**Value**	**Unit**
	Drilling	Point Source	0.114301676	g/s
	Blasting	Point Source	0.004719299	g/s
	Mineral Loading	Point Source	0.046388403	g/s
	Haul Road	Line Source	0.002506292	g/s
	Overall Mine	Area Source	0.063382147	g/s
Estimated Emission Rate for SO_2	Overall Mine	Area Source	0.001649600	g/s
Estimated Emission Rate for NOx	Overall Mine	Area Source	0.000107104	g/s

Source: Emission Calculation

TABLE 7.11: INCREMENTAL & RESULTANT GLC WITHIN CLUSTER

PM_{10} in µg/m^3	
Background	42.4
Incremental	14.80
Resultant	57.2
NAAQ Norms	**100 µg/m^3**
$PM_{2.5}$ in µg/m^3	
Background	22.3
Incremental	6.89
Resultant	29.19
NAAQ Norms	**60 µg/ m^3**
So2 in µg/m^3	
Background	6.7
Incremental	1.87
Resultant	8.57
NAAQ Norms	**80 µg/ m^3**
No2 in µg/m^3	
Background	24.1
Incremental	9.73
Resultant	33.83
NAAQ Norms	**80 µg/ m^3**

Noise Environment –

Noise pollution is mainly due to operation like drilling & blasting and plying of trucks & HEMM. Cumulative Noise modelling has been carried out considering blasting and compressor operation (drilling) and transportation activities. Predictions have been carried out to compute the noise level at various distances around the different quarries within the 500 m radius.

For hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations at different sources using model based on first principle.

$$Lp_2 = Lp_1 - 20 \log (r_2/r_1) - Ae_{1,2}$$

Where:

Lp_1 & Lp_2 are sound levels at points located at distances r_1 & r_2 from the source.

$Ae_{1,2}$ is the excess attenuation due to environmental conditions. Combined effect of all sources can be determined at various locations by logarithmic addition.

$$Lp_{total} = 10 \log \{10^{(Lp1/10)} + 10^{(Lp2/10)} + 10^{(Lp3/10)} + \ldots\ldots\}$$

Attenuation due to Green Belt has been taken to be 4.9 dB (A). The inputs required for the model are:

Source data has been computed taking into account of all the machinery and activities used in the mining process.

TABLE 7.12: PREDICTED NOISE INCREMENTAL VALUES FROM CLUSTER

Location ID	Background Value (Day) dB(A)	Incremental Value dB(A)	Total Predicted dB(A)	Residential Area Standards dB(A)
Habitation Near P1	51.6	42.4	52.1	55
Habitation Near P2	51.0	44.1	51.8	
Habitation Near E1	49.0	43.0	52.8	
Habitation Near E2	50.8	44.7	53.4	

Source: Lab Monitoring Data

The incremental noise level is found within the range of 42.4 – 44.7 dB (A) in Buffer zone. The noise level at different receptors in buffer zone is lower due to the distance involved and other topographical features adding to the noise attenuation. The resultant Noise level due to monitored values and calculated values at the receptors are based on the mathematical formula considering attenuation due to Green Belt as 4.9 dB (A)the barrier effect. From the above table, it can be seen that the ambient noise levels at all the locations near habitations are within permissible limits of Residential Area (buffer zone) as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000(The Principal Rules were published in the Gazette of India, vide S.O.123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E),dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment(Protection) Act, 1986).

Ground Vibrations

Ground vibrations due to mining activities in the all the 4 Mines within cluster are anticipated due to operation of Mining Machines like Excavators, drilling and blasting, transportation vehicles, etc. However, the major source of ground vibration from the all the 4 mines is blasting. The major impact of the ground vibrations is observed on the domestic houses located in the villages nearby the mine lease area. The kuchha houses are more prone to cracks and damage due to the vibrations induced by blasting whereas RCC framed structures can withstand more ground vibrations. Apart from this, the ground vibrations may develop a fear factor in the nearby settlements.

Another impact due to blasting activities is fly rocks. These may fall on the houses or agricultural fields nearby the mining areas and may cause injury to persons or damage to the structures.

Nearest Habitations from 11 mines respectively are as in below Table 7.21.

TABLE 7.13: NEAREST HABITATION FROM EACH MINE

Location ID	Distance & Direction
Habitation Near P1	570m SW
Habitation Near P2	800m SW
Habitation Near E1	350m West
Habitation Near E2	760m SW

The ground vibrations due to the blasting in all the mines are calculated using the empirical equation for assessment of peak particle velocity (PPV) is:

$$V = K [R/Q^{0.5}]^{-B}$$

Where –

V = peak particle velocity (mm/s)

K = site and rock factor constant

Q = maximum instantaneous charge (kg)

B = constant related to the rock and site (usually 1.6)

R = distance from charge (m)

TABLE 7.14: GROUND VIBRATIONS AT 4 MINES

Location ID	Maximum Charge in kgs	Nearest Habitation in m	PPV in m/ms
P1	75	570m SW	0.616
P2	33	800m SW	1.180
E1	195	350m West	2.887
E2	146	760m SW	0.662

Source: Blasting Calculations

From the above table, the charge per blast is considered as maximum in each mine and the resultant PPV is well below the Peak Particle Velocity of 8 mm/s as per Directorate General of Mines Safety for safe level criteria through Circular No. 7 dated 29/8/1997.

Socio Economic Environment –

The 4 mines shall contribute towards CER and the community shall develop.

TABLE 7.15: SOCIO ECONOMIC BENEFITS FROM 4 MINES

Location ID	Project Cost	CER
P1	Rs.54,37,000	Rs.5,00,000
P2	Rs. 5,70,44,000	Rs.5,00,000
Total	**Rs. 6,24,81,000**	**Rs.10,00,000**
E1	Rs.56,74,000	Rs.5,00,000
E2	Rs.59,97,360	Rs.5,00,000
Total	**Rs. 1,16,71,360**	**Rs.10,00,000**
Grand Total	**Rs. 7,41,52,360**	**Rs. 20,00,000**

As per para 6 (II) of the office memorandum, all the mines being a green field project & Capital Investment is ≤ 100 crores, they shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC.

- Proposed Projects shall fund towards CER – **Rs 10,00,000/-**
- Existing Projects shall fund towards CER – **Rs. 10,00,000/-**
- Projects in Cluster shall fund towards CER – **Rs 20,00,000/-**

TABLE 7.16: EMPLOYMENT BENEFITS FROM 4 MINES

Description	Employment
P1	34
P2	48
Total	**82**
E1	30
E2	35
Total	**65**
Grand Total	**147**

A total of 82 people will get employment due to 2 proposed mine in cluster and 65 people are already employed at existing mines.

TABLE 7.17: GREENBELT DEVELOPMENT BENEFITS FROM 4 MINES

Code	No of Trees proposed to be planted	Survival %	Area	Name of the Species	No. of Trees expected to be grown
P1	1700	80%	Safety Barrier, approach roads and village roads	Neem, Pungmia Vilvam, etc.,	1425
P2	4800	80%			3840
P3	2400	80%			1920
P4	1700	80%			1425
Total	**10,600**				**8,610**

Based on the Proposed Mining Plans it's anticipated that there shall growth of native species of Neem, Pungmia Pinnata, etc in the Cluster at a rate of 10,600 Trees Planted over a period of 5 Years with Survival Rate of 80% and

expected growth is around 8,610 Trees over an area of Safety Barrier, approach roads and village roads in Proposed Quarry.

7.5 PLASTIC WASTE MANAGEMENT PLAN

The Project Proponent shall comply with Tamil Nadu Government Order (Ms) No. 84 Environment and Forest (EC.2) Department Dated: 25.06.2018 regarding ban on one time use and throw away plastics irrespective of thickness with effect from 01.01.2019 under Environment (Protection) Act, 1986.

Objective –

- To investigate the actual supply chain network of plastic waste.
- To identify and propose a sustainable plastic waste management by installing bins for collection of recyclables with all the plastic waste
- Preparation of a system design layout, and necessary modalities for implementation and monitoring.

TABLE 7.18: ACTION PLAN TO MANAGE PLASTIC WASTE

Sl.No.	Activity	Responsibility
1	Framing of Layout Design by incorporating provision of the Rules, user fee to be charged from waste generators for plastic waste management, penalties/fines for littering, burning plastic waste or committing any other acts of public nuisance	Mines Manager
2	Enforcing waste generators to practice segregation of bio-degradable, recyclable and domestic hazardous waste	Mines Manager
3	Collection of plastic waste	Mines Foreman
4	Setting up of Material Recovery Facilities	Mines Manager
5	Segregation of Recyclable and Non-Recyclable plastic waste at Material Recovery Facilities	Mines Foreman
6	Channelization of Recyclable Plastic Waste to registered recyclers	Mines Foreman
7	Channelization of Non-Recyclable Plastic Waste for use either in Cement kilns, in Road Construction	Mines Foreman
8	Creating awareness among all the stakeholders about their responsibility	Mines Manager
9	Surprise checking's of littering, open burning of plastic waste or committing any other acts of public nuisance	Mine Owner

Source: Proposed by FAE's and EC

8. PROJECT BENEFITS

8.0 GENERAL

Tvl.Thirupathi Blue Metals Rough Stone & Gravel Quarries for Quarrying at Enthoor Village aims to produce 14,17,020 m^3 Rough Stone & 1,68,622 m^3 Gravel over a period of 5 Years. This will enhance the socio-economic activities in the adjoining areas and will result in the following benefits

- Increase in Employment Potential
- Improvement in Socio-Economic Welfare
- Improvement in Physical Infrastructure
- Improvement in Social infrastructure

8.1 EMPLOYMENT POTENTIAL

It is proposed to provide employment to about 82 persons for carrying out mining operations and give preference to the local people in providing employment in the one proposed quarry in the cluster. In addition, there will be opportunity for indirect employment to many people in the form of contractual jobs, business opportunities, service facilities etc. the economic status of the local people will be enhanced due to mining project.

8.2 SOCIO-ECONOMIC WELFARE MEASURES PROPOSED

The impact of mining activity in the area will be more positive on the socio-economic environment in the immediate project impact area. The employment opportunities both direct and indirect will contribute to enhanced money incomes to job seekers with minimal skill sets especially among the local communities.

8.3 IMPROVEMENT IN PHYSICAL INFRASTRUCTURE

Yvl.Thirupathi blue Metals Rough Stone & Gravel is located in PEnthoor Village, Marakkanam Taluk and Viluppuram District of Tamil Nadu and the area have communications, roads and other facilities already well established. The following physical infrastructure facilities will further improve due to proposed mine.

- Road Transport facilities
- Communications
- Medical, Educational and social benefits will be made available to the nearby civilian population in addition to the workmen employed in the mine.

8.4 IMPROVEMENT IN SOCIAL INFRASTRUCTURE

Employment is expected during civil construction period, in trade, garbage lifting, sanitation and other ancillary services, Employment in these sectors will be primarily temporary or contractual and involvement of unskilled labour will be more. A major part of the labour force will be mainly from local villagers who are expected to engage themselves both in agriculture and mining activities. This will enhance their income and lead to overall economic growth of the area.

8.5 OTHER TANGIBLE BENEFITS

The proposed mine is likely to have other tangible benefits as given below.

- Indirect employment opportunities to local people in contractual works like construction of infrastructural facilities, transportation, sanitation, for supply of goods and services to the mine and other community services.
- Additional housing demand for rental accommodation will increase
- Cultural, recreation and aesthetic facilities will also improve
- Improvement in communication, transport, education, community development and medical facilities and overall change in employment and income opportunity
- The State Government will also benefit directly from the proposed mine, through increased revenue from royalties, cess, DMF, GST etc.,

CORPORATE SOCIAL RESPONSIBILITY

Individual Project Proponents will take responsibility to develop awareness among all levels of their staff about CSR activities and the integration of social processes with business processes. Those involved with the undertaking of CSR activities will be provided with adequate training and re-orientation.

Under this programme, the project proponents will take-up following programmes for social and economic development of villages within 10 km of the project site. For this purpose, separate budget will be provided every year. For finalization of these schemes, proponent will interact with LSG. The schemes will be selected from the following broad areas –

- Health Services
- Social Development
- Infrastructure Development
- Education & Sports
- Self-Employment

CSR Cost Estimation

- CSR activities will be taken up in the Enthoor village mainly contributing to education, health, training of women self-help groups and contribution to infrastructure etc., CSR budget is allocated as 2.5% of the profit.

CORPORATE ENVIRONMENT RESPONSIBILITY

Allocation for Corporate Environment Responsibility (CER) shall be made as per Government of India, MoEF & CC Office Memorandum F.No.22-65/2017-IA.III, Dated: 01.05.2018.

As per para 6 (II) of the office memorandum, being a green field project & Capital Investment is ≤ 100 crores, the proposed project shall contribute 2% of Capital Investment towards CER as per directions of EAC/SEAC. Cumulative Capital cost is Rs. 6, 24, 81,000 /- and same works out to Rs. 10,00,000/-

TABLE 8.1: CER – ACTION PLAN

Code	CER
P1	Rs 5,00,000/-
P2	Rs 5,00,000/-
Total	**Rs 10,00,000/-**

Source: Field survey conducted by FAE, consultation with project proponents

9. ENVIRONMENTAL COST BENEFIT ANALYSIS

Not Applicable, Since Environmental Cost Benefit Analysis not recommended at the Scoping stage.

10. ENVIRONMENTAL MANAGEMENT PLAN-P1

10.0 GENERAL

Environment Management Plan (EMP) aims at the preservation of ecological system by considering in-built pollution abatement facilities at the proposed site. Good practices of Environmental Management plan will ensure to keep all the environmental parameters of the project in respect of Ambient Air quality, Water quality, Socio – economic improvement standards.

Mitigation measures at the source level and an overall environment management plan at the study area are elicited so as to improve the supportive capacity of the receiving bodies. The EMP presented in this chapter discusses the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored after approval of the EIA.

10.1 ENVIRONMENTAL POLICY

The Project Proponent is committed to conduct all its operations and activities in an environmentally responsible manner and to continually improve environmental performance.

The Proponent Tvl.Thirupathi Blue metals will –

- Meet the requirements of all laws, acts, regulations, and standards relevant to its operations and activities
- Implement a program to train employees in general environmental issues and individual workplace environmental responsibilities
- Allocate necessary resources to ensure the implementation of the environmental policy
- Ensure that an effective closure strategy is in place at all stages of project development and that progressive reclamation is undertaken as early as possible to reduce potential long-term environmental and community impacts
- Implement monitoring programmes to provide early warning of any deficiency or unanticipated performance in environmental safeguards
- Conduct periodic reviews to verify environmental performance and to continuously strive towards improvement.

Description of the Administration and Technical Setup –

The Environment Monitoring Cell discussed under Chapter 6 will ensure effective implementation of environment management plan and to ensure compliance of environmental statutory guidelines through Mine Management Level of each Proposed Quarry.

The said team will be responsible for:

- Monitoring of the water/ waste water quality, air quality and solid waste generated
- Analysis of the water and air samples collected through external laboratory
- Implementation and monitoring of the pollution control and protective measures/ devices which shall include financial estimation, ordering, installation of air pollution control equipment, waste water treatment plant, etc.
- Co-ordination of the environment related activities within the project as well as with outside agencies
- Collection of health statistics of the workers and population of the surrounding villages
- Green belt development
- Monitoring the progress of implementation of the environmental monitoring programme
- Compliance to statutory provisions, norms of State Pollution Control Board, Ministry of Environment and Forests and the conditions of the environmental clearance as well as the consents to establish and consents to operate.

10.2 LAND ENVIRONMENT MANAGEMENT –

Landscape of the area will be changed due to the quarrying operation, restoration of the land by converting the quarry pit into temporary reservoir and the remaining part of the area (un utilized areas, infrastructure, haul Roads) will be utilized for greenbelt development. Aesthetic of the Environment will not be affected. There is no major vegetation in the project area during the course of quarrying operation and after completion of the quarrying operation thick plantation will be developed under greenbelt development programme.

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

CONTROL	RESPONSIBILITY
Design vehicle wash-down areas so that all runoff water is captured and passed through oil water separators and sediment catchment devices.	Mines Manager
Refueling to be undertaken in a safe location, away from vehicle movement pathways&100 m away of any watercourse Refueling activity to be under visual observation at all times. Drainage of refueling areas to sumps with oil/water separation	Mine Foreman & Mining Mate
Soil and groundwater testing as required following up a particular incident of contamination.	Mines Manager
At conceptual stage, the mining pits will be converted into Rain Water Harvesting. Remaining area will be converted into greenbelt area	Mines Manager
No external dumping i.e., outside the project area	Mine Foreman
Garland drains with catch pits / settlement traps to be provided all around the project area to prevent run off affecting the surrounding lands.	Mines Manager
The periphery of Project area will be planted with thick plantation to arrest the fugitive dust, which will also act as acoustic barrier.	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.3 SOIL MANAGEMENT

There is no overburden or waste anticipated from proposed project.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

CONTROL	RESPONSIBILITY
Surface run-off from the project boundary via garland drains will be diverted to the mine pits	Mine Foreman & Mining Mate
Design haul roads and other access roads with drainage systems to minimize concentration of flow and erosion risk	Mines Manager
Empty sediment from sediment traps Maintain, repair or upgrade garland drain system	Mines Manager
Test soils for pH, EC, chloride, size & water holding capacity	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.4 WATER MANAGEMENT

In the proposed quarrying project, no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mines office.

The quarrying operation is proposed upto a depth of **37 m BGL**, the water table in the area is 47m – 51 m below ground level, hence the proposed projects will not intersect the Ground water table during entire quarry period.

TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT

CONTROL	RESPONSIBILITY
To maximize the reuse of pit water for water supply	Mines Foreman
Temporary and permanent garland drain will be constructed to contain the catchments of the mining area and to divert runoff from undisturbed areas through the mining areas	Mines Manager
Natural drains/nallahs/brooklets outside the project area should not be disturbed at any point of mining operations	Mines Manager
Ensure there is no process effluent generation or discharge from the project area into water bodies	Mines Foreman
Domestic sewage generated from the project area will be disposed in septic tank and soak pit system	Mines Foreman

Monthly or after rainfall, inspection for performance of water management structures and systems	Mines Manager
Conduct ground water and surface water monitoring for parameters specified by CPCB	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.5 AIR QUALITY MANAGEMENT

The proposed quarrying activity would result in the increase of particulate matter concentrations due to fugitive dust. Daily water sprinkling on the haul roads, approach roads in the vicinity would be undertaken and will be continued as there is possibility for dust generation due to truck mobility. It will be ensured that vehicles are properly maintained to comply with exhaust emission requirements.

TABLE 10.4: PROPOSED CONTROLS FOR AIR ENVIRONMENT

CONTROL	RESPONSIBILITY
Generation of dust during excavation is minimized by daily (twice) water sprinkling on working face and daily (twice) water sprinkling on haul road	Mines Manager
Wet drilling procedure /drills with dust extractor system to control dust generation during drilling at source itself is implemented	Mines Manager
Maintenance as per operator manual of the equipment and machinery in the mines to minimizing air pollution	Mines Manager
Ambient Air Quality Monitoring carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted air pollution control measures	Mines Manager
Provision of Dust Mask to all workers	Mines Manager
Greenbelt development all along the periphery of the project area	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.6 NOISE POLLUTION CONTROL

There will be intermittent noise levels due to vehicular movement, trucks loading, drilling and blasting and cutting activities. No mining activities are planned during night time.

TABLE 10.5: PROPOSED CONTROLS FOR NOISE ENVIRONMENT

CONTROL	RESPONSIBILITY
Development of thick greenbelt all along the Buffer Zone (7.5 Meters) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn-out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager
Provision of earmuff / ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager
Sharp drill bits are used to minimize noise from drilling	Mines Foreman
Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring are carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted noise control measures. Additional noise control measures will be adopted if required as per the observations during monitoring	Mines Manager
Reduce maximum instantaneous charge using delays while blasting	Mining Mate
Change the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination	Mines Manager
Undertake noise or vibration monitoring	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.7 GROUND VIBRATION AND FLY ROCK CONTROL

The Rough stone quarry operation creates vibration due to the blasting and movement of Heavy Earth moving machineries, fly rocks due to the blasting.

TABLE 10.6: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK

CONTROL	RESPONSIBILITY
Controlled blasting using delay detonators will be carried out to maintain the PPV value (below 8Hz) well within the prescribed standards of DGMS	Mines Manager
Drilling and blasting will be carried under the supervision of qualified persons	Mines Manager
Proper stemming of holes should be carried out with statutory competent qualified blaster under the supervision of statutory mines manager to avoid any anomalies during blasting	Mines Manager
Suitable spacing and burden will be maintained to avoid misfire / fly rocks	Manager Mines
Number of blast holes will be restricted to control ground vibrations	Manager Mines
Blasting will be carried out only during noon time	Mining Mate
Undertake noise or vibration monitoring	Mines Manager
ensure blast holes are adequately stemmed for the depth of the hole and stemmed with suitable angular material	Mines Foreman

Source: Proposed by FAE's & EIA Coordinator

10.8 BIOLOGICAL ENVIRONMENT MANAGEMENT

The proponent will take all necessary steps to avoid the impact on the ecology of the area by adopting suitable management measures in the planning and implementation stage. During mining, thick plantation will be carried out around the project periphery, on safety barrier zone, on top benches of quarried out area etc.,

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.

- Greenbelt development all along the safety barrier of the project area
- It is also proposed to implement the greenbelt development programme and post plantation status will be regularly checked for every season.
- The main attributes that retard the survival of sapling is fugitive dust, this fugitive dust can be controlled by water sprinkling on the haul roads and installing a sprinkler unit near the newly planted area.
- Year wise greenbelt development will be recorded and monitored
    - Based on the area of plantation.
    - Period of plantation
    - Type of plantation
    - Spacing between the plants
    - Type of manuring and fertilizers and its periods
    - Lopping period, interval of watering
    - Survival rate
    - Density of plantation
- The ultimate reclamation planned leaves a congenial environment for development of flora & immigration of small fauna through green belt and water reservoir. The green belt and water reservoir developed within the Project at the end of mine life will attract the birds and animals towards the project area in the post mining period.

10.8.1 Green Belt Development Plan

About 1700 nos. of saplings is proposed to be planted for the Mining plan period in safety barrier of applied mine lease area with survival rate 80%. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

TABLE 10.7: PROPOSED GREENBELT ACTIVITIES FOR5 YEAR PLAN PERIOD

Year	No. of tress proposed to be planted	Area	Name of the species	Survival rate expected in %	No. of trees expected to be grown
I	1700	Safety barrier, village roads	Neem, Pongamia Pinnata, etc.,	80	1360

Source: Conceptual Plan of Approved Mining plan & proposed by FAE's & EIA Coordinator

The objectives of the greenbelt development plan are –

- Provide a green belt around the periphery of the quarry area to combat the dispersal of dust in the adjoining areas,
- Protect the erosion of the soil, Conserve moisture for increasing ground water recharging,
- Restore the ecology of the area, restore aesthetic beauty of the locality and meet the requirement of fodder, fuel and timber of the local community.

A well-planned Green Belt with multi rows (three tiers) preferably with long canopy leaves shall be developed with dense plantations around the boundary and haul roads to prevent air, dust noise propagation to undesired places and efforts will be taken for the enhancement of survival rate.

10.8.2 Species Recommended for Plantation

Following points have been considered while recommending the species for plantation:

- Creating of bio-diversity.
- Fast growing, thick canopy cover, perennial and evergreen large leaf area,
- Efficient in absorbing pollutants without major effects on natural growth

TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT

S.No	Botanical Name	Local Name	Importance
1.	Azadirachta indica	Neem, Vembu	Neem oil & neem products
2.	Tamarindus indica	Tamarind	Edible & Medicinal and other Uses
3.	Polyalthia longifolia	Nettilinkam	Tall and evergreen tree
4.	Borassus Flabellifer	Palmyra Palm	Tall Wind breaker tree and its fruits are edible

Source: Proposed by FAE's & EIA Coordinator

10.9 OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

Occupational safety and health are very closely related to productivity and good employer-employee relationship. The main factors of occupational health impact in quarries are fugitive dust and noise. Safety of employees during quarrying operation and maintenance of mining equipment will be taken care as per Mines Act 1952 and Rule 29 of Mines Rules 1955. To avoid any adverse effect on the health of workers due to dust, noise and vibration sufficient measures have been provided.

10.9.1 Medical Surveillance and Examinations –

- Identifying workers with conditions that may be aggravated by exposure to dust & noise and establishing baseline measures for determining changes in health.
- Evaluating the effect of noise on workers
- Enabling corrective actions to be taken when necessary
- Providing health education

The health status of workers in the mine shall be regularly monitored under an occupational surveillance program. Under this program, all the employees are subjected to a detailed medical examination at the time of employment. The medical examination covers the following tests under mines act 1952.

- General Physical Examination and Blood Pressure
- X-ray Chest and ECG

- Sputum test
- Detailed Routine Blood and Urine examination

The medical histories of all employees will be maintained in a standard format annually. Thereafter, the employees will be subject to medical examination annually. The below tests keep upgrading the database of medical history of the employees.

TABLE 10.9: MEDICAL EXAMINATION SCHEDULE

Sl.No	Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Initial Medical Examination (Mine Workers)					
A	Physical Check-up					
B	Psychological Test					
C	Audiometric Test					
D	Respiratory Test					
2	Periodical Medical Examination (Mine Workers)					
A	Physical Check – up					
B	Audiometric Test					
C	Eye Check – up					
D	Respiratory Test					
3	Medical Camp (Mine Workers & Nearby Villagers)					
4	Training (Mine Workers)					

Medical Follow ups:- Work force will be divided into three targeted groups age wise as follows:-		
Age Group	**PME as per Mines Rules 1955**	**Special Examination**
Less than 25 years	Once in a Three Years	In case of emergencies
Between 25 to 40 Years	Once in a Three Years	In case of emergencies
Above 40 Years	Once in a Three Years	In case of emergencies
Medical help on top priority immediately after diagnosis/ accident is the essence of preventive aspects.		

10.9.2 Proposed Occupational Health and Safety Measures –

- The mine site will have adequate drinking water supply so that workers do not get dehydrated.
- Lightweight and loose-fitting clothes having light colours will be preferred to wear.
- Noise exposure measurements will be taken to determine the need for noise control strategies.
- The personal protective equipment will be provided for mine workers.
- Supervisor will be instructed for reporting any problems with hearing protectors or noise control equipment.
- At noisy working activity, exposure time will be minimized.
- Dust generating sources will be identified and proper control measure will be adopted.
- Periodic medical examinations will be provided for all workers.
- Strict observance of the provisions of DGMS Acts, Rules and Regulations in respect of safety both by management and the workers.
- The width of road will be maintained more than thrice the width of the vehicle. A code of traffic rules will be implemented.
- In respect of contract work, safety code for contractors and workers will be implemented. They will be allowed to work under strict supervision of statutory person/officials only after they will impart training at vocational training centres. All personal protective equipment's will be provided to them.
- A safety committee meeting every month will be organized to discuss the safety of the mines and the persons employed.
- Celebration of annual mines safety week and environmental week in order to develop safety awareness and harmony amongst employees and co quarry owners.

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS

10.9.3. Health and Safety Training Programme

The Proponent will provide special induction program along with machinery manufacturers for the operators and co-operators to run and maintain the machinery effectively and efficiently. The training program for the supervisors and office staffs will be arranged in the Group Vocational Training Centres in the State and engage Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner.

TABLE 10.10: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES

Course	Personnel	Frequency	Duration	Instruction
New-Employee Training	All new employees exposed to mine hazards	Once	One week	Employee rights Supervisor responsibilities Self-rescue Respiratory devices Transportation controls Communication systems Escape and emergency evacuation Ground control hazards Occupational health hazards Electrical hazards First aid Explosives
Task Training Like Drilling, Blasting, Stemming, safety, Slope	Employees assigned to new work tasks	Before new Assignments	Variable	Task-specific health &safety procedures and SOP for various mining activity.

stability, Dewatering, Haul road maintenance,				Supervised practice in assigned work tasks.
Refresher Training	All employees who received new-hire training	Yearly	One week	Required health and safety standards Transportation controls Communication systems Escape ways, emergency evacuations Fire warning Ground control hazards First aid Electrical hazards Accident prevention Explosives Respirator devices
Hazard Training	All employees exposed to mine hazards	Once	Variable	Hazard recognition and avoidance Emergency evacuation procedures Health standards Safety rules Respiratory devices

Source: Proposed by FAE's & EIA Coordinator as per DGMS Norms

10.9.4. Budgetary Provision for Environmental Management –

Adequate budgetary provision has been made by the Company for execution of Environmental Management Plan. The Table 10.11 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

TABLE 10.11: EMP BUDGET FOR PROPOSED PROJECT

	Mitigation Measure	Provision for Implementation	Capital	Recurring
Air Environment	Compaction, gradation and drainage on both sides for Haulage Road	Rental Dozer & drainage construction on haul road @ Rs. 10,000/- per hectare; and yearly maintenance @ Rs. 10,000/- per hectare	28550	28550
	Fixed Water Sprinkling Arrangements + Water sprinkling by own water tankers	Fixed Sprinkler Installation and New Water Tanker Cost for Capital; and Water Sprinkling (thrice a day) Cost for recurring	800000	50000
	Muffle blasting – To control fly rocks during blasting	Blasting face will be covered with sand bags / steel mesh / old tyres / used conveyor belts	0	5000
	Wet drilling procedure / latest eco-friendly drill machine with separate dust extractor unit	Dust extractor @ Rs. 25,000/- per unit deployed as capital & @ Rs. 2500 per unit recurring cost for maintenance - 8Units	200000	20000
	No overloading of trucks/tippers/tractors	Manual Monitoring through Security guard	0	5000
	Stone carrying trucks will be covered by tarpaulin	Monitoring if trucks will be covered by tarpaulin	0	10000
	Enforcing speed limits of 20 km/hr within ML area	Installation of Speed Governers @ Rs. 5000/- per Tipper/Dumper deployed - 4 Units	20000	1000
	Regular monitoring of exhaust fumes as per RTO norms	Monitoring of Exhaust Fumes by Manual Labour	0	5000
	Regular sweeping and maintenance of approach roads for at least about 200 m from ML Area	Provision for 2 labours @ Rs.10,000/labour (Contractual) per Hectare	0	57100
	Installing wheel wash system near gate of quarry	Installation + Maintenance + Supervision	50000	20000
Noise Environment	Source of noise will be during operation of transportation vehicles, HEMM for this proper	Provision made in Operating Cost	0	0

	maintenance will be done at regular intervals.			
	Oiling & greasing of Transport vehicles and HEMM at regular interval will be done	Provision made in Operating Cost	0	0
	Adequate silencers will be provided in all the diesel engines of vehicles.	Provision made in Operating Cost	0	0
	It will be ensured that all transportation vehicles carry a fitness certificate.	Provision made in Operating Cost	0	0
	Safety tools and implements that are required will be kept adequately near blasting site at the time of charging.	Provision made in OHS part	0	0
	Line Drilling all along the boundary to reduce the PPV from blasting activity and implementing controlled blasting.	Provision made in Operating Cost	0	0
	Proper warning system before blasting will be adopted and clearance of the area before blasting will be ensured.	Blowing Whistle by Mining Mate / Blaster / Compentent Person	0	0
	Provision for Portable blaster shed	Installation of Portable blasting shelter	50000	2000
	NONEL Blasting will be practiced to control Ground vibration and fly rocks	Rs. 30/- per 6 Tonnes of Blasted Material	0	681127
Waste Management	Waste management (Spent Oil, Grease etc.,)	Provision for domestic waste collection and disposal through authorized agency	5000	20000
		Installation of dust bins	5000	2000
	Bio toilets will be made available outside mine lease on the land of owner itself	Provision made in Operating Cost	0	0
Mine Closure	1. Progressive Closure Activity - Surface Runoff managent	Provision for garland drain @ Rs. 10,000/- per Hectare with maintenance of Rs. 5,000/- per annum	28550	5000

	2. Progressive Closure Activity Barbed Wire Fencing to quarry area will be provisioned.	Per Hectare fencing Cost @ Rs. 2,00,000/- with Maintenance of Rs 10,000/- per annum	571000	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 1700 Tress (700 Tress inside the lease area and 1000 **Trees outside the lease area)**	Site clearance, preparation of land, digging of pits / trenches, soil amendments, transplantation of saplings @ 200 per plant (capital) for plantation inside the lease area and @ 30 per plant maintenance (recurring)	140000	21000
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	300000	30000
	4. Implementation of Final Mine Closure Actity as per Approved Mining Plan on Last Year	Few activities already covered as progressive closure activities as greenbelt development, wire fencing, garland drain. *For Final Closure Activities 15% of the proposed closure cost will be spent during the final mine closure stage - Last Year	123750	0
	5. Contribution towards Green Fund. As per TNMMCR 1959, Rule 35 A	The Contribution towards Green Funds @ 10% of Seigniorage fee are indicated as part of EMP Budge and not necessarily implemented in the Project Site	1545635	
Implementation of EC, Mining Plan & DGMS Condition- Public hearing commitment	Size 6’ X 5’ with blue background and white letters as mentioned in MoM Appendix II by the SEAC TN	Fixed Display Board at the Quarry Entrance as permanent structure mentioning Environmental Conditions	10000	1000
	Air, Water, Noise and Soil Quality Sampling every 6 Months for Compliance Report of EC Conditions	Submission of 2 Half Yearly Compliance - Lab Monitoring Report as per CPCB norms	0	50000

	Workers will be provided with Personal Protective Equipment's	Provision of PPE @ Rs. 4000/- per employee with recurring based on wear and tear (say, @ Rs. 1000/- per employee) - 34 Employees	136000	34000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	34000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	5710
	Mine will have safety precaution signages, boards.	Provision for signages and boards made	10000	2000
	No parking will be provided on the transport routes. Separate provision on the south side of the hill will be made for vehicles /HEMMs. Flaggers will be deployed for traffic management	Parking area with shelter and flags @ Rs. 50,000/- per hectare project and Rs. 10,000/- as maintenance cost	142750	10000
	Installation of CCTV cameras in the mines and mine entrance	Camera 4 Nos, DVR, Monitor with internet facility	30000	5000
	Implementation as per Mining Plan and ensure safe quarry working	Mines Manager (1st Class / 2nd Class / Mine Foreman) under regulation 34 / 34 (6) of MMR, 1961 and Mining Mate under regulation 116 of MMR,1961 @ 40,000/- for Manager & @ 25,000/- for Foreman / Mate	0	780000
	Construction of Greenmesh along with wire fencing around the lease area	Per Hectare greenmesh cost @ Rs. 50,000/- with Maintenance of Rs 20,000/- per annum	1,50,000	20,000
CER	As per MoEF &CC OM 22-65/2017-IA.III Dated 25.02.2021	Detailed Description in following slides and Budget allocation is included as per MoeEF & CC OM	500000	
TOTAL			**4722484.8**	**1914487.2**

Yearwse Break Up Cost

Year	Total Cost
1st	Rs.66,36,972
2nd	Rs.20,10,211
3rd	Rs.21,10,722
4th	Rs.22,16,258
5th	Rs.24,50,821

Cost inflation 5% per annum

Note: This Environmental Management plan cost will vary according to the public consultation comments

In order to implement the environmental protection measures, an amount of Rs.47.22 lakhs as capital cost and recurring cost as Rs. 19.14 lakhs as recurring cost is proposed considering present market price considering present market scenario for the proposed project.

10. ENVIRONMENTAL MANAGEMENT PLAN-P2

10.0 GENERAL

Environment Management Plan (EMP) aims at the preservation of ecological system by considering in-built pollution abatement facilities at the proposed site. Good practices of Environmental Management plan will ensure to keep all the environmental parameters of the project in respect of Ambient Air quality, Water quality, Socio – economic improvement standards.

Mitigation measures at the source level and an overall environment management plan at the study area are elicited so as to improve the supportive capacity of the receiving bodies. The EMP presented in this chapter discusses the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored after approval of the EIA.

10.1 ENVIRONMENTAL POLICY

The Project Proponent is committed to conduct all its operations and activities in an environmentally responsible manner and to continually improve environmental performance.

The Proponent Tvl.Thirupathi blue metals will –

- Meet the requirements of all laws, acts, regulations, and standards relevant to its operations and activities
- Implement a program to train employees in general environmental issues and individual workplace environmental responsibilities
- Allocate necessary resources to ensure the implementation of the environmental policy
- Ensure that an effective closure strategy is in place at all stages of project development and that progressive reclamation is undertaken as early as possible to reduce potential long-term environmental and community impacts
- Implement monitoring programmes to provide early warning of any deficiency or unanticipated performance in environmental safeguards
- Conduct periodic reviews to verify environmental performance and to continuously strive towards improvement.

Description of the Administration and Technical Setup –

The Environment Monitoring Cell discussed under Chapter 6 will ensure effective implementation of environment management plan and to ensure compliance of environmental statutory guidelines through Mine Management Level of each Proposed Quarry.

The said team will be responsible for:

- Monitoring of the water/ waste water quality, air quality and solid waste generated
- Analysis of the water and air samples collected through external laboratory
- Implementation and monitoring of the pollution control and protective measures/ devices which shall include financial estimation, ordering, installation of air pollution control equipment, waste water treatment plant, etc.
- Co-ordination of the environment related activities within the project as well as with outside agencies
- Collection of health statistics of the workers and population of the surrounding villages
- Green belt development
- Monitoring the progress of implementation of the environmental monitoring programme
- Compliance to statutory provisions, norms of State Pollution Control Board, Ministry of Environment and Forests and the conditions of the environmental clearance as well as the consents to establish and consents to operate.

10.2 LAND ENVIRONMENT MANAGEMENT –

Landscape of the area will be changed due to the quarrying operation, restoration of the land by converting the quarry pit into temporary reservoir and the remaining part of the area (un utilized areas, infrastructure, haul Roads) will be utilized for greenbelt development. Aesthetic of the Environment will not be affected. There is no major vegetation in the project area during the course of quarrying operation and after completion of the quarrying operation thick plantation will be developed under greenbelt development programme.

TABLE 10.1: PROPOSED CONTROLS FOR LAND ENVIRONMENT

CONTROL	RESPONSIBILITY
Design vehicle wash-down areas so that all runoff water is captured and passed through oil water separators and sediment catchment devices.	Mines Manager
Refueling to be undertaken in a safe location, away from vehicle movement pathways&100 m away of any watercourse Refueling activity to be under visual observation at all times. Drainage of refueling areas to sumps with oil/water separation	Mine Foreman & Mining Mate
Soil and groundwater testing as required following up a particular incident of contamination.	Mines Manager
At conceptual stage, the mining pits will be converted into Rain Water Harvesting. Remaining area will be converted into greenbelt area	Mines Manager
No external dumping i.e., outside the project area	Mine Foreman
Garland drains with catch pits / settlement traps to be provided all around the project area to prevent run off affecting the surrounding lands.	Mines Manager
The periphery of Project area will be planted with thick plantation to arrest the fugitive dust, which will also act as acoustic barrier.	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.3 SOIL MANAGEMENT

There is no overburden or waste anticipated from proposed project.

TABLE 10.2: PROPOSED CONTROLS FOR SOIL MANAGEMENT

CONTROL	RESPONSIBILITY
Surface run-off from the project boundary via garland drains will be diverted to the mine pits	Mine Foreman & Mining Mate
Design haul roads and other access roads with drainage systems to minimize concentration of flow and erosion risk	Mines Manager
Empty sediment from sediment traps Maintain, repair or upgrade garland drain system	Mines Manager
Test soils for pH, EC, chloride, size & water holding capacity	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.4 WATER MANAGEMENT

In the proposed quarrying project, no process is involved for the effluent generation, only oil & grease from the machinery wash is anticipated and domestic sewage from mines office.

The quarrying operation is proposed upto a depth of **45 m BGL**, the water table in the area is 65m – 68 m below ground level, hence the proposed projects will not intersect the Ground water table during entire quarry period.

TABLE 10.3: PROPOSED CONTROLS FOR WATER ENVIRONMENT

CONTROL	RESPONSIBILITY
To maximize the reuse of pit water for water supply	Mines Foreman
Temporary and permanent garland drain will be constructed to contain the catchments of the mining area and to divert runoff from undisturbed areas through the mining areas	Mines Manager
Natural drains/nallahs/brooklets outside the project area should not be disturbed at any point of mining operations	Mines Manager
Ensure there is no process effluent generation or discharge from the project area into water bodies	Mines Foreman

Domestic sewage generated from the project area will be disposed in septic tank and soak pit system	Mines Foreman
Monthly or after rainfall, inspection for performance of water management structures and systems	Mines Manager
Conduct ground water and surface water monitoring for parameters specified by CPCB	Manager Mines

Source: Proposed by FAE's & EIA Coordinator

10.5 AIR QUALITY MANAGEMENT

The proposed quarrying activity would result in the increase of particulate matter concentrations due to fugitive dust. Daily water sprinkling on the haul roads, approach roads in the vicinity would be undertaken and will be continued as there is possibility for dust generation due to truck mobility. It will be ensured that vehicles are properly maintained to comply with exhaust emission requirements.

TABLE 10.4: PROPOSED CONTROLS FOR AIR ENVIRONMENT

CONTROL	RESPONSIBILITY
Generation of dust during excavation is minimized by daily (twice) water sprinkling on working face and daily (twice) water sprinkling on haul road	Mines Manager
Wet drilling procedure /drills with dust extractor system to control dust generation during drilling at source itself is implemented	Mines Manager
Maintenance as per operator manual of the equipment and machinery in the mines to minimizing air pollution	Mines Manager
Ambient Air Quality Monitoring carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted air pollution control measures	Mines Manager
Provision of Dust Mask to all workers	Mines Manager
Greenbelt development all along the periphery of the project area	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.6 NOISE POLLUTION CONTROL

There will be intermittent noise levels due to vehicular movement, trucks loading, drilling and blasting and cutting activities. No mining activities are planned during night time.

TABLE 10.5: PROPOSED CONTROLS FOR NOISE ENVIRONMENT

CONTROL	RESPONSIBILITY
Development of thick greenbelt all along the Buffer Zone (7.5 Meters) of the project area to attenuate the noise and the same will be maintained	Mines Manager
Preventive maintenance of mining machinery and replacement of worn-out accessories to control noise generation	Mines Foreman
Deployment of mining equipment with an inbuilt mechanism to reduce noise	Mines Manager
Provision of earmuff / ear plugs to workers working in noise prone zones in the mines	Mining Mate
Provision of effective silencers for mining machinery and transport vehicles	Mines Manager
Provision of sound proof AC operator cabins to HEMM	Mines Manager
Sharp drill bits are used to minimize noise from drilling	Mines Foreman
Controlled blasting technologies are adopted by using delay detonators to minimize noise from blasting	Mines Manager
Annual ambient noise level monitoring are carried out in the project area and in surrounding villages to access the impact due to the mining activities and the efficacy of the adopted noise control measures. Additional noise control measures will be adopted if required as per the observations during monitoring	Mines Manager
Reduce maximum instantaneous charge using delays while blasting	Mining Mate
Change the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination	Mines Manager
Undertake noise or vibration monitoring	Mines Manager

Source: Proposed by FAE's & EIA Coordinator

10.7 GROUND VIBRATION AND FLY ROCK CONTROL

The Rough stone quarry operation creates vibration due to the blasting and movement of Heavy Earth moving machineries, fly rocks due to the blasting.

TABLE 10.6: PROPOSED CONTROLS FOR GROUND VIBRATIONS & FLY ROCK

CONTROL	RESPONSIBILITY
Controlled blasting using delay detonators will be carried out to maintain the PPV value (below 8Hz) well within the prescribed standards of DGMS	Mines Manager
Drilling and blasting will be carried under the supervision of qualified persons	Mines Manager
Proper stemming of holes should be carried out with statutory competent qualified blaster under the supervision of statutory mines manager to avoid any anomalies during blasting	Mines Manager
Suitable spacing and burden will be maintained to avoid misfire / fly rocks	Manager Mines
Number of blast holes will be restricted to control ground vibrations	Manager Mines
Blasting will be carried out only during noon time	Mining Mate
Undertake noise or vibration monitoring	Mines Manager
ensure blast holes are adequately stemmed for the depth of the hole and stemmed with suitable angular material	Mines Foreman

Source: Proposed by FAE's & EIA Coordinator

10.8 BIOLOGICAL ENVIRONMENT MANAGEMENT

The proponent will take all necessary steps to avoid the impact on the ecology of the area by adopting suitable management measures in the planning and implementation stage. During mining, thick plantation will be carried out around the project periphery, on safety barrier zone, on top benches of quarried out area etc.,

Following control measures are proposed for its management and will be the responsibility of the Mines Manager.

- Greenbelt development all along the safety barrier of the project area
- It is also proposed to implement the greenbelt development programme and post plantation status will be regularly checked for every season.
- The main attributes that retard the survival of sapling is fugitive dust, this fugitive dust can be controlled by water sprinkling on the haul roads and installing a sprinkler unit near the newly planted area.
- Year wise greenbelt development will be recorded and monitored
    - Based on the area of plantation.
    - Period of plantation
    - Type of plantation
    - Spacing between the plants
    - Type of manuring and fertilizers and its periods
    - Lopping period, interval of watering
    - Survival rate
    - Density of plantation
- The ultimate reclamation planned leaves a congenial environment for development of flora & immigration of small fauna through green belt and water reservoir. The green belt and water reservoir developed within the Project at the end of mine life will attract the birds and animals towards the project area in the post mining period.

10.8.1 Green Belt Development Plan

About 4800 nos. of saplings is proposed to be planted for the Mining plan period in safety barrier of applied mine lease area with survival rate 80%. The greenbelt development plan has been prepared keeping in view the land use changes that will occur due to mining operation in the area.

TABLE 10.7: PROPOSED GREENBELT ACTIVITIES FOR5 YEAR PLAN PERIOD

Year	No. of tress proposed to be planted	Area	Name of the species	Survival rate expected in %	No. of trees expected to be grown
I	4800	Safety barrier, village roads	Neem, Pongamia Pinnata, etc.,	80	3840

Source: Conceptual Plan of Approved Mining plan & proposed by FAE's & EIA Coordinator

The objectives of the greenbelt development plan are –

- Provide a green belt around the periphery of the quarry area to combat the dispersal of dust in the adjoining areas,
- Protect the erosion of the soil, Conserve moisture for increasing ground water recharging,
- Restore the ecology of the area, restore aesthetic beauty of the locality and meet the requirement of fodder, fuel and timber of the local community.

A well-planned Green Belt with multi rows (three tiers) preferably with long canopy leaves shall be developed with dense plantations around the boundary and haul roads to prevent air, dust noise propagation to undesired places and efforts will be taken for the enhancement of survival rate.

10.8.2 Species Recommended for Plantation

Following points have been considered while recommending the species for plantation:

- Creating of bio-diversity.
- Fast growing, thick canopy cover, perennial and evergreen large leaf area,
- Efficient in absorbing pollutants without major effects on natural growth

TABLE 10.8: RECOMMENDED SPECIES TO PLANT IN THE GREENBELT

S.No	Botanical Name	Local Name	Importance
5.	Azadirachta indica	Neem, Vembu	Neem oil & neem products
6.	Tamarindus indica	Tamarind	Edible & Medicinal and other Uses
7.	Polyalthia longifolia	Nettilinkam	Tall and evergreen tree
8.	Borassus Flabellifer	Palmyra Palm	Tall Wind breaker tree and its fruits are edible

Source: Proposed by FAE's & EIA Coordinator

10.9 OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

Occupational safety and health are very closely related to productivity and good employer-employee relationship. The main factors of occupational health impact in quarries are fugitive dust and noise. Safety of employees during quarrying operation and maintenance of mining equipment will be taken care as per Mines Act 1952 and Rule 29 of Mines Rules 1955. To avoid any adverse effect on the health of workers due to dust, noise and vibration sufficient measures have been provided.

10.9.1 Medical Surveillance and Examinations –

- Identifying workers with conditions that may be aggravated by exposure to dust & noise and establishing baseline measures for determining changes in health.
- Evaluating the effect of noise on workers
- Enabling corrective actions to be taken when necessary
- Providing health education

The health status of workers in the mine shall be regularly monitored under an occupational surveillance program. Under this program, all the employees are subjected to a detailed medical examination at the time of employment. The medical examination covers the following tests under mines act 1952.

- General Physical Examination and Blood Pressure

- X-ray Chest and ECG
- Sputum test
- Detailed Routine Blood and Urine examination

The medical histories of all employees will be maintained in a standard format annually. Thereafter, the employees will be subject to medical examination annually. The below tests keep upgrading the database of medical history of the employees.

TABLE 10.9: MEDICAL EXAMINATION SCHEDULE

Sl.No	Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Initial Medical Examination (Mine Workers)					
A	Physical Check-up					
B	Psychological Test					
C	Audiometric Test					
D	Respiratory Test					
2	Periodical Medical Examination (Mine Workers)					
A	Physical Check – up					
B	Audiometric Test					
C	Eye Check – up					
D	Respiratory Test					
3	Medical Camp (Mine Workers & Nearby Villagers)					
4	Training (Mine Workers)					

Medical Follow ups:- Work force will be divided into three targeted groups age wise as follows:-		
Age Group	**PME as per Mines Rules 1955**	**Special Examination**
Less than 25 years	Once in a Three Years	In case of emergencies
Between 25 to 40 Years	Once in a Three Years	In case of emergencies
Above 40 Years	Once in a Three Years	In case of emergencies
Medical help on top priority immediately after diagnosis/ accident is the essence of preventive aspects.		

10.9.2 Proposed Occupational Health and Safety Measures –

- The mine site will have adequate drinking water supply so that workers do not get dehydrated.
- Lightweight and loose-fitting clothes having light colours will be preferred to wear.
- Noise exposure measurements will be taken to determine the need for noise control strategies.
- The personal protective equipment will be provided for mine workers.
- Supervisor will be instructed for reporting any problems with hearing protectors or noise control equipment.
- At noisy working activity, exposure time will be minimized.
- Dust generating sources will be identified and proper control measure will be adopted.
- Periodic medical examinations will be provided for all workers.
- Strict observance of the provisions of DGMS Acts, Rules and Regulations in respect of safety both by management and the workers.
- The width of road will be maintained more than thrice the width of the vehicle. A code of traffic rules will be implemented.
- In respect of contract work, safety code for contractors and workers will be implemented. They will be allowed to work under strict supervision of statutory person/officials only after they will impart training at vocational training centres. All personal protective equipment's will be provided to them.
- A safety committee meeting every month will be organized to discuss the safety of the mines and the persons employed.
- Celebration of annual mines safety week and environmental week in order to develop safety awareness and harmony amongst employees and co quarry owners.

FIGURE 10.1: PERSONAL PROTECTIVE EQUIPMENT TO THE MINE WORKERS

10.9.3. Health and Safety Training Programme

The Proponent will provide special induction program along with machinery manufacturers for the operators and co-operators to run and maintain the machinery effectively and efficiently. The training program for the supervisors and office staffs will be arranged in the Group Vocational Training Centres in the State and engage Environmental Consultants to provide periodical training to all the employees to carry out the mining operation in and eco-friendly manner.

TABLE 10.10: LIST OF PERIODICAL TRAININGS PROPOSED FOR EMPLOYEES

Course	Personnel	Frequency	Duration	Instruction
New-Employee Training	All new employees exposed to mine hazards	Once	One week	Employee rights Supervisor responsibilities Self-rescue Respiratory devices Transportation controls Communication systems Escape and emergency evacuation Ground control hazards Occupational health hazards Electrical hazards First aid Explosives
Task Training Like Drilling, Blasting, Stemming, safety, Slope stability, Dewatering, Haul road maintenance,	Employees assigned to new work tasks	Before new Assignments	Variable	Task-specific health &safety procedures and SOP for various mining activity. Supervised practice in assigned work tasks.
Refresher Training	All employees who received new-hire training	Yearly	One week	Required health and safety standards Transportation controls Communication systems Escape ways, emergency evacuations Fire warning Ground control hazards First aid Electrical hazards Accident prevention Explosives Respirator devices
Hazard Training	All employees exposed to mine hazards	Once	Variable	Hazard recognition and avoidance Emergency evacuation procedures Health standards Safety rules Respiratory devices

Source: Proposed by FAE's & EIA Coordinator as per DGMS Norms

10.9.4. Budgetary Provision for Environmental Management –

Adequate budgetary provision has been made by the Company for execution of Environmental Management Plan. The Table 10.11 gives overall investment on the environmental safeguards and recurring expenditure for successful monitoring and implementation of control measures.

TABLE 10.11: EMP BUDGET FOR PROPOSED PROJECT

	Mitigation Measure	Provision for Implementation	Capital	Recurring
Air Environment	Compaction, gradation and drainage on both sides for Haulage Road	Rental Dozer & drainage construction on haul road @ Rs. 10,000/- per hectare; and yearly maintenance @ Rs. 10,000/- per hectare	80005	80005
	Fixed Water Sprinkling Arrangements + Water sprinkling by own water tankers	Fixed Sprinkler Installation and New Water Tanker Cost for Capital; and Water Sprinkling (thrice a day) Cost for recurring	800000	50000
	Muffle blasting – To control fly rocks during blasting	Blasting face will be covered with sand bags / steel mesh / old tyres / used conveyor belts	0	5000
	Wet drilling procedure / latest eco-friendly drill machine with separate dust extractor unit	Dust extractor @ Rs. 25,000/- per unit deployed as capital & @ Rs. 2500 per unit recurring cost for maintenance - 6 Units	150000	15000
	No overloading of trucks/tippers/tractors	Manual Monitoring through Security guard	0	5000
	Stone carrying trucks will be covered by tarpaulin	Monitoring if trucks will be covered by tarpaulin	0	10000
	Enforcing speed limits of 20 km/hr within ML area	Installation of Speed Governers @ Rs. 5000/- per Tipper/Dumper deployed - 8 Units	40000	2000
	Regular monitoring of exhaust fumes as per RTO norms	Monitoring of Exhaust Fumes by Manual Labour	0	5000
	Regular sweeping and maintenance of approach roads for at least about 200 m from ML Area	Provision for 2 labours @ Rs.10,000/labour (Contractual) per Hectare	0	160010
	Installing wheel wash system near gate of quarry	Installation + Maintenance + Supervision	50000	20000

Noise Environment	Source of noise will be during operation of transportation vehicles, HEMM for this proper maintenance will be done at regular intervals.	Provision made in Operating Cost	0	0
	Oiling & greasing of Transport vehicles and HEMM at regular interval will be done	Provision made in Operating Cost	0	0
	Adequate silencers will be provided in all the diesel engines of vehicles.	Provision made in Operating Cost	0	0
	It will be ensured that all transportation vehicles carry a fitness certificate.	Provision made in Operating Cost	0	0
	Safety tools and implements that are required will be kept adequately near blasting site at the time of charging.	Provision made in OHS part	0	0
	Line Drilling all along the boundary to reduce the PPV from blasting activity and implementing controlled blasting.	Provision made in Operating Cost	0	0
	Proper warning system before blasting will be adopted and clearance of the area before blasting will be ensured.	Blowing Whistle by Mining Mate / Blaster / Compentent Person	0	0
	Provision for Portable blaster shed	Installation of Portable blasting shelter	50000	2000
	NONEL Blasting will be practiced to control Ground vibration and fly rocks	Rs. 30/- per 6 Tonnes of Blasted Material	0	3003125
Waste Management	Waste management (Spent Oil, Grease etc.,)	Provision for domestic waste collection and disposal through authorized agency	5000	20000
		Installation of dust bins	5000	2000
	Bio toilets will be made available outside mine lease on the land of owner itself	Provision made in Operating Cost	0	0
Mine Closure	1. Progressive Closure Activity - Surface Runoff managent	Provision for garland drain @ Rs. 10,000/- per Hectare with maintenance of Rs. 5,000/- per annum	80005	5000

	2. Progressive Closure Activity Barbed Wire Fencing to quarry area will be provisioned.	Per Hectare fencing Cost @ Rs. 2,00,000/- with Maintenance of Rs 10,000/- per annum	1600100	10000
	3. Progressive Closure Activity Green belt development - 500 trees per one hectare - Proposal for 4800Tress (900Tress inside the lease area and 3900 **Trees outside the lease area)**	Site clearance, preparation of land, digging of pits / trenches, soil amendments, transplantation of saplings @ 200 per plant (capital) for plantation inside the lease area and @ 30 per plant maintenance (recurring)	180000	27000
		Avenue Plantation @ 300 per plant (capital) for plantation outside the lease area and @ 30 per plant maintenance (recurring)	1170000	117000
	4. Implementation of Final Mine Closure Actity as per Approved Mining Plan on Last Year	Few activities already covered as progressive closure activities as greenbelt development, wire fencing, garland drain. *For Final Closure Activities 15% of the proposed closure cost will be spent during the final mine closure stage - Last Year	202050	0
	5. Contribution towards Green Fund. As per TNMMCR 1959, Rule 35 A	The Contribution towards Green Funds @ 10% of Seigniorage fee are indicated as part of EMP Budge and not necessarily implemented in the Project Site	6814783	
Implementation of EC, Mining Plan & DGMS Condition-Public	Size 6’ X 5’ with blue background and white letters as mentioned in MoM Appendix II by the SEAC TN	Fixed Display Board at the Quarry Entrance as permanent structure mentioning Environmental Conditions	10000	1000

hearing commitment	Air, Water, Noise and Soil Quality Sampling every 6 Months for Compliance Report of EC Conditions	Submission of 2 Half Yearly Compliance - Lab Monitoring Report as per CPCB norms	0	50000
	Workers will be provided with Personal Protective Equipment's	Provision of PPE @ Rs. 4000/- per employee with recurring based on wear and tear (say, @ Rs. 1000/- per employee) - 48 **Employees**	192000	48000
	Health check up for workers will be provisioned	IME & PME Health check up @ Rs. 1000/- per employee	0	48000
	First aid facility will be provided	Provision of 2 Kits per Hectare @ Rs. 2000/-	0	16001
	Mine will have safety precaution signages, boards.	Provision for signages and boards made	10000	2000
	No parking will be provided on the transport routes. Separate provision on the south side of the hill will be made for vehicles /HEMMs. Flaggers will be deployed for traffic management	Parking area with shelter and flags @ Rs. 50,000/- per hectare project and Rs. 10,000/- as maintenance cost	400025	10000
	Installation of CCTV cameras in the mines and mine entrance	Camera 4 Nos, DVR, Monitor with internet facility	30000	5000
	Implementation as per Mining Plan and ensure safe quarry working	Mines Manager (1st Class / 2nd Class / Mine Foreman) under regulation 34 / 34 (6) of MMR, 1961 and Mining Mate under regulation 116 of MMR,1961 @ 40,000/- for Manager & @ 25,000/- for Foreman / Mate	0	780000
	Construction of Greenmesh along with wire fencing around the lease area	Per Hectare greenmesh cost @ Rs. 50,000/- with Maintenance of Rs 20,000/- per annum	1,50,000	20,000

CER	As per MoEF &CC OM 22-65/2017-IA.III Dated 25.02.2021	Detailed Description in following slides and Budget allocation is included as per MoeEF & CC OM	500000	
TOTAL			**12316918**	**4518140**

Yearwse Break Up Cost

Year	Total Cost
1st	Rs.1,68,35,059
2nd	Rs.47,44,047
3rd	Rs.49,81,250
4th	Rs.52,30,312
5th	Rs.56,93,878

Cost inflation 5% per annum

Note: This Environmental Management plan cost will vary according to the public consultation comments

In order to implement the environmental protection measures, an amount of Rs.123.16 lakhs as capital cost and recurring cost as Rs45.18 lakhs as recurring cost is proposed considering present market price considering present market scenario for the proposed project.

10.10 CONCLUSION –

Various aspects of mining activities were considered and related impacts were evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and fund has been allocated for the same. The EMP is dynamic, flexible and subjected to periodic review. For project where the major environmental impacts are associated, EMP will be under regular review. Senior Management responsible for the project will conduct a review of EMP and its implementation to ensure that the EMP remains effective and appropriate. Thus, the proper steps will be taken to accomplish all the goals mentioned in the EMP and the project will bring the positive impact in the study area.

11. SUMMARY AND CONCLUSION

Tvl.Thirupathi Blue Metals Rough Stone and Gravel Quarries **(Extent – 17.64.55 ha)** consisting of 2 Proposed, 2 Existing Quarries falls under "B" category as per MoEF & CC Notification S.O. 3977 (E).

Now, as per Order Dated: 04.09.2018 & 13.09.2018 passed by Hon'ble National Green Tribunal, New Delhi in O.A. No. 173 of 2018 & O.A. No, 186 of 2016 and MoEF & CC Office Memorandum F. No. L-11011/175/2018-IA-II (M) Dated: 12.12.2018 clarified the requirement for EIA, EMP and therefore, Public Consultation for all areas from 5 to 25 ha falling in Category B-1 and appraised by SEAC/ SEIAA as well as for cluster situation.

The proposed projects are categorized under category "B1" Activity 1(a) (mining lease area in cluster situation) and will be considered at SEIAA – TN after conducting Public Hearing and Submission of EIA/EMP Report for Grant of Environmental Clearance. **"**Draft EIA report prepared on the basis of ToR Issued for carrying out public hearing for the grant of Environmental Clearance from SEIAA, Tamil Nadu".

Environmental monitoring and audit mechanism have been recommended before and after commencement of the project, where necessary, to verify the accuracy of the EIA predictions and the effectiveness of recommended mitigation measures.

The main scope of the EIA study is to quantify the cumulative impact in the study area due to cluster quarries and formulate the effective mitigation measures for each individual leases. A detailed account of the emission sources, emissions control equipment, background Air quality levels, Meteorological measurements, Dispersion model and all other aspects of pollution like effluent discharge, Dust generation etc., have been discussed in this report. The baseline monitoring study has been carried out during the months March 2023 to May 2023 for various environmental components so as to assess the anticipated impacts of the cluster quarry projects on the environment and suitable mitigation measures for likely adverse impacts due to the proposed project is suggested individually for the respective proposed project under Chapter 10.

The project proponent ensures to obtain necessary clearances and quarrying will be carried out as per rules and regulations. The Mining Activity will be carried out in a phased manner as per the approved mining plan after obtaining EC, CTO from TNPCB, execution of lease deed and obtaining DGMS Permission and working will be carried out under the supervision of Competent Persons employed.

Overall, the EIA report has predicted that the project will comply with all environment standards and legislation after commencement of the project and operational stage mitigation measures are implemented.

Mining operations has positive impact on environment and socio economy such as landscape improvement, water as by-product, economy development and better public services, providing and supply of Rough Stone as per market demand.

Sustainable and modern mining leads us to see positive impact of mining operation and providing consistent employment for nearly 82 people directly in the proposed projects and indirectly around 150 people.

As discussed, it is safe to say that the proposed quarries are not likely to cause any significant impact to the ecology of the area, as adequate preventive measures will be adopted to keep the various pollutants within the permissible limits. Green belt development around the area will also be taken up as an effective pollution mitigate technique, as well as to serve as biological indicators for the pollutants released from Tvl.Thirupathi Blue Metals Rough Stone and Gravel Quarries **(Extent – 17.64.55 ha)**

12. DISCLOSURE OF CONSULTANT

Tvl.Thirupathi Blue Metals Rough Stone and Gravel Quarries have engaged M/s Geo Exploration and Mining Solutions, an Accredited Organization under Quality Council of India – National Accreditation Board for Education & Training, New Delhi, for carrying out the EIA Study as per the ToR Issued for the proposed projects.

Name and address of the consultancy:

GEO EXPLORATION AND MINING SOLUTIONS

No 17, Advaitha Ashram Road,
Alagapuram, Salem – 636 004
Tamil Nadu, India
Email:infogeoexploration@gmail.com
Web: www.gemssalem.com
Phone: 0427 2431989.

The Accredited Experts and associated members who were engaged for this EIA study as given below –

Sl.No.	Name of the expert	In house/ Empanelled	EIA Coordinator		FAE	
			Sector	Category	Sector	Category
1	**Dr. M. Ifthikhar Ahmed**	**In-house**	**1**	**A**	WP GEO SC	B A A
2	Dr. P. Thangaraju	In-house	-	-	HG GEO	A A
3	Mr. A. Jagannathan	In-house	-	-	AP NV SHW	B A B
4	Mr. N. Senthilkumar	Empanelled	38 28	B B	AQ WP RH	B B A
5	Mrs. Jisha parameswaran	In-house	-	-	SW	B
6	Mr. Govindasamy	In-house	-	-	WP	B
7	Mrs. K. Anitha	In-house	-	-	SE	A
8	Mrs. Amirtham	In-house	-	-	EB	B
9	Mr. Alagappa Moses	Empanelled	-	-	EB	A
10	Mr. A. Allimuthu	In-house	-	-	LU	B
11	Mr. S. Pavel	Empanelled	-	-	RH	B
12	Mr. J. R. Vikram Krishna	Empanelled	-	-	SHW RH	A A

Abbreviations			
EC	EIA Coordinator	EB	Ecology and bio-diversity
AEC	Associate EIA Coordinator	NV	Noise and vibration
FAE	Functional Area Expert	SE	Socio economics
FAA	Functional Area Associates	HG	Hydrology, ground water and water conservation
TM	Team Member	SC	Soil conservation
GEO	Geology	RH	Risk assessment and hazard management
WP	Water pollution monitoring, prevention and control	SHW	Solid and hazardous wastes
AP	Air pollution monitoring, prevention and control	MSW	Municipal Solid Wastes
LU	Land Use	ISW	Industrial Solid Wastes
AQ	Meteorology, air quality modeling, and prediction	HW	Hazardous Wastes

DECLARATION BY EXPERTS CONTRIBUTING TO THE EIA/EMP

Declaration by experts contributing to the EIA/EMP for Tvl.Thirupathi Blue Metals Rough Stone and Gravel Quarries Project over an Extent of 17.64.55 ha in Enthoor Village of Marakkanam Taluk, Viluppuram District of Tamil Nadu. It is also certified that information furnished in the above EIA study are true and correct to the best of our knowledge.

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the EIA/EMP Report.

Name**:** **Dr. M. Ifthikhar Ahmed**

Designation**:** **EIA Coordinator**

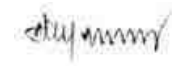
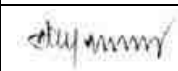
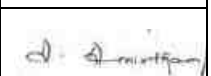
Date & Signature:

Period of Involvement: **January 2022 to till date**

Associated Team Member with EIA Coordinator:

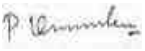
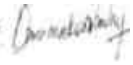
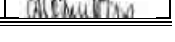
1. **Mr.P. Viswanathan**
2. **Mr. M. Santhoshkumar**
3. **Mr. S. Ilavarasan**

FUNCTIONAL AREA EXPERTS ENGAGED IN THE PROJECT

Sl. No.	Functional Area	Involvement	Name of the Expert/s	Signature
1	AP	▪ Identification of different sources of air pollution due to the proposed mine activity ▪ Prediction of air pollution and propose mitigation measures / control measures	Mr. A. Jagannathan	
2	WP	▪ Suggesting water treatment systems, drainage facilities ▪ Evaluating probable impacts of effluent/waste water discharges into the receiving environment/water bodies and suggesting control measures.	Dr. M. Ifthikhar Ahmed	
			Mr. N. Senthilkumar	
3	HG	▪ Interpretation of ground water table and predict impact and propose mitigation measures. ▪ Analysis and description of aquifer Characteristics	Dr. P. Thangaraju	
4	GEO	▪ Field Survey for assessing the regional and local geology of the area. ▪ Preparation of mineral and geological maps. ▪ Geology and Geo morphological analysis/description and Stratigraphy/Lithology.	Dr. M. Ifthikhar Ahmed	
			Dr. P. Thangaraju	
5	SE	▪ Revision in secondary data as per Census of India, 2011. ▪ Impact Assessment & Preventive Management Plan ▪ Corporate Environment Responsibility.	Mrs. K. Anitha	
6	EB	▪ Collection of Baseline data of Flora and Fauna. ▪ Identification of species labelled as Rare, Endangered and threatened as per IUCN list.	Mrs. Amirtham	

		▪ Impact of the project on flora and fauna. ▪ Suggesting species for greenbelt development.	Mr. Alagappa Moses	
7	RH	▪ Identification of hazards and hazardous substances ▪ Risks and consequences analysis ▪ Vulnerability assessment ▪ Preparation of Emergency Preparedness Plan ▪ Management plan for safety.	Mr. N. Senthilkumar	
			Mr. S. Pavel	
			Mr. J. R. Vikram Krishna	
8	LU	▪ Construction of Land use Map ▪ Impact of project on surrounding land use ▪ Suggesting post closure sustainable land use and mitigative measures.	Mr. A. Allimuthu	
9	NV	▪ Identify impacts due to noise and vibrations ▪ Suggesting appropriate mitigation measures for EMP.	Mr. A. Jagannathan	
10	AQ	▪ Identifying different source of emissions and propose predictions of incremental GLC using AERMOD. ▪ Recommending mitigations measures for EMP	Mr. N. Senthilkumar	
11	SC	▪ Assessing the impact on soil environment and proposed mitigation measures for soil conservation	Dr. M. Ifthikhar Ahmed	
12	SHW	▪ Identify source of generation of non-hazardous solid waste and hazardous waste. ▪ Suggesting measures for minimization of generation of waste and how it can be reused or recycled.	Mr. A. Jagannathan	
			Mr. J. R. Vikram Krishna	

LIST OF TEAM MEMBERS ENGAGED IN THIS PROJECT

Sl.No.	Name	Functional Area	Involvement	Signature
1	Mr. S. Nagamani	AP; GEO; AQ	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Provide inputs on Geological Aspects ▪ Analyse & provide inputs and assist FAE with meteorological data, emission estimation, AERMOD modelling and suggesting control measures	
2	Mr. Viswathanan	AP; WP; LU	▪ Site Visit with FAE ▪ Provide inputs & Assisting FAE with sources of Air Pollution, its impact and suggest control measures ▪ Assisting FAE on sources of water pollution, its impacts and suggest control measures ▪ Assisting FAE in preparation of land use maps	
3	Mr. Santhoshkumar	GEO; SC	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
4	Mr. Umamahesvaran	GEO	▪ Site Visit with FAE ▪ Provide inputs on Geological Aspects ▪ Assist in Resources & Reserve Calculation and preparation of Production Plan & Conceptual Plan	
5	Mr. A. Allimuthu	SE	▪ Site Visit with FAE	

			▪ Assist FAE with collection of data's ▪ Provide inputs by analysing primary and secondary data	
6	Mr. S. Ilavarasan	LU; SC	▪ Site Visit with FAE ▪ Assisting FAE in preparation of land use maps ▪ Provide inputs & Assisting FAE with soil conservation methods and identifying impacts	
7	Mr. E. Vadivel	HG	▪ Site Visit with FAE ▪ Assist FAE & provide inputs on aquifer characteristics, ground water level/table ▪ Assist with methods of ground water recharge and conduct pump test, flow rate	
8	Mr. D. Dinesh	NV	▪ Site Visit with FAE ▪ Assist FAE and provide inputs on impacts due to proposed mine activity and suggest mitigation measures ▪ Assist FAE with prediction modelling	
9	Mr. Panneer Selvam	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	
10	Mrs. Nathiya	EB	▪ Site Visit with FAE ▪ Assist FAE with collection of baseline data ▪ Provide inputs and assist with labelling of Flora and Fauna	

DECLARATION BY THE HEAD OF THE ACCREDITED CONSULTANT ORGANIZATION

I, Dr. M. Ifthikhar Ahmed, Managing Partner, Geo Exploration and Mining Solutions, hereby, confirm that the above-mentioned Functional Area Experts and Team Members prepared the EIA/EMP for Tvl.Thirupathi Blue Metals Rough Stone & Gravel Quarries Project over an Extent of 17.64.55 ha in Enthoor Village of Marakkanam Taluk, Viluppuram District of Tamil Nadu. It is also certified that information furnished in the EIA study are true and correct to the best of our knowledge.

Signature& Date: 

Name: **Dr. M. Ifthikhar Ahmed**

Designation: **Managing Partner**

Name of the EIA Consultant Organization: **M/s. Geo Exploration and Mining Solutions**

NABET Certificate No & Issue Date: **NABET/EIA/2225/RA 0276 Dated: 20-02-2023**
Validity: **Valid till 06.08.2025**